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THE PHILADELPHIA ASPHALT TESTS.

THE articles in the July and September numbers of PAVING AND MUNICIPAL ENGINEERING, giving results of tests of asphalts, made in Philadelphia, with articles commenting on the same, seem to attract more attention than their real importance demands. To justify this deprecatory remark, attention is called to the failure of the experimenters to observe certain conditions essential to accurate investigations of the problem.

The reader's attention is called to a related article, page 147, in the April number of this magazine. Quoting therefrom we read, "The cohesive strength of an asphalt varies with its fluidity throughout the range of its viscous condition," and "There are coefficients of changes in the fluidity, depending respectively upon temperature, inorganic admixtures in it, and upon the percentages of certain groups of its hydro-carbon elements."

It will be readily appreciated that tests of cohesive strength or of penetration can not be compared unless some account and value is placed upon the degree of fluidity of the asphaltic cements. In the practical use of these cements great importance is attached to this quality, and their strength varying in high degree with variations of fluidity, it is seen that by ignoring this condition of the samples in the tests under consideration, the results are without value for purposes of comparison. The mixing in an asphalt of any stated percentage of oil or maltha, regardless of the softening effect produced, is to ignore all practice followed in the use of these materials, and must give results that will be misleading. A very hard mixture of Bermudez asphalt and Utah maltha gave high results, not necessarily because of the superiority of the materials,

but because of lacking fluidity. And yet greater accuracy would have resulted had the experimenters first determined the effects of varying percentages of insoluble components in the repective samples. For these reasons the inferences drawn from the results obtained by the tests have no special value, and do not warrant the conclusions drawn from them.

Another unsatisfactory condition of the tests is in regard to the temperature and duration of the preparatory treatment followed in making the cements. Was this operation so made as to effect the complete blending of the asphalt with the tempering material? The time during which a test piece is under stress should be recorded for purposes of comparison elsewhere, for, at any temperature at which the cement will flow under the stress to which subjected, it quickly changes its sectional area, so as to lessen the results of the test. The softer the cement, or as it is preferred to say, the more fluid it is, the more rapidly it yields to the stress, and the more vitiated are the results obtained. For these reasons there should be a record of the degree of comparative fluidity, and of the length of time the stress is applied. Considering all these things it appears that the new era has not yet arrived.

The present opinion held by the writer is, that tests of cohesive strength have little if any value for determining the relative value of asphalts for paving uses, as all asphalts investigated have more than sufficient strength, and the surplus strength of any asphalt, compared with others, is probably of no more value than is the surplus depth of the sea; an ocean half a mile deep is fully as navigable as another which may be two or three miles deep.

A general conclusion formed by the writer last winter, is to the effect that there are no differences in cohesive strength, with the asphalts in prominent use in this country, sufficiently marked to be available for deciding any one to be better than the others for paving uses. This stated with some reservation until the investigations undertaken are fully completed.

Considering the physical conditions of an asphaltic mixture upon which the wearing quality of a pavement depends it appears that high cohesive strength may be a subordinate element of the problem. This is indicated by the circumstance that, to be durable, the surface mixture must be, it is held, plastic in warm weather, and

this plasticity indicates fluidity, which is evidence of lessened cohesive strength. In this state the percussive blows on the sand in the mixture, from the calks of horseshoes, etc., causes the grains of sand to shift their position, without being pulverized, as otherwise they might be. For illustration of the protective influence conferred by this plasticity of the cement, take the case of laying a sheet of rubber or leather on an anvil, sprinkling sand over it and trying to crush the sand with a hammer. The yielding cushion protects the sand from destruction. A pavement mixture must be strong enough to resist deformation at the highest temperature to which it may be subjected, and the less it hardens at lower temperatures, the wider the range of its serviceable plasticity; unless, of course, some interfering condition may be observed. If maltha mixtures harden in a pavement more rapidly than do those of oil, the greater the likelihood that they are less desirable, as such hardening is an indication of molecular changes.

The writer was, for several years, firm in the conviction that maltha would be a better material for tempering paving cements than the residuum oil customarily used. The determining consideration is, he now believes, that of subsequent chemical stability of the compound, and thinks that some effort should be made to determine this point; and that until such determination can be made it will not be prudent to change the current practice.

Contrary to the generally accepted opinion he believes the oil does form a chemical union with the asphalt when the mixing is properly done. This being true it follows that cements made by treatment which does not fully effect such chemical union will be im perfect ones; and tests made with them inconclusive as to the value of the materials. As to the quality of residuum oils used in the construction of any particular pavement, they should be the best obtainable in a commercial way; the distilling being conducted to produce a requisite quality, not an incidental by-product.

The writer has worked many months, and has made two or three thousand tests of cohesive strength of asphalts crude and refined, and of cements, and hopes to be able to designate, finally, the relative importance of the more important influences affecting the strength of asphaltic cements and pavement mixtures. The reader is referred to an article in the May, 1894, number of this magazine,

wherein something is said concerning the process used by him in getting, by solution, four important fractions of an asphalt. The information gained by combining these in various proportions will, it is believed, prove of considerable help for the comparative valuation of asphalts.

Assuming that changes of the cohesive strength of an asphalt are indications of molecular changes in the material, he has freed samples from insoluble materials, to obtain what may be called physically pure asphalt. This is combined with various per centages of oil, and the samples so made have been tested at several temperatures, to find what modifications of strength the oil effects. For each point of testing five tests are made, and an average result secured for record. The results admit of graphic representation, and thereby the most ready and comprehensive comparison. In like manner trial has been made of the influence which different percentages of stone dust effect in the way of cohesive strength of cements. These also admit of graphic representation and comparison. It is much too early, in the investigations being made, to venture any announcement of definite conclusions.

Dolphus Torrey.

SPECIFICATIONS FOR BRICK PAVEMENTS.

THERE are many points which commend brick as a paving material. It is easily handled and makes a handsome pavement, but where the bricks are vitrified until they become brittle, they do not make a durable work, and this is, of course, a very serious objection. But where traffic is light, properly laid brick pavements are very satisfactory, making a clean and lasting roadway, and one much less noisy and cheaper than granite. It may be said, however, that the use of brick for pavements is still in an experimental stage, and probably some time must elapse before a definite conclusion can be reached as to their real value.

During the last few years the writer has observed the following points in regard to brick and brick pavements, and they are given with the hope that they will add to, if not improve, the rather meager data on the subject, and be of some use to those who have this class of work to do.

From a series of experiments made recently on soft brick, the conclusion has been reached that the crushing strength per square inch of a quarter of a brick is about half that of a whole one, or a half brick about two-thirds, and three-fourths of a brick about five-sixths as strong per square inch as a whole one; or in other words, the strength of a quarter, a half and three-quarters of a brick and a whole one, are to each other as three, four, five and six respectively. The reason for this difference is apparent if it be conceived that a whole brick is made up of a number of cubes placed side by side, in which case it is clear that the interior cubes will be stronger than the exterior ones, because of the side support derived from the latter.

Some experimenters test whole bricks while others test halves. It is recommended that tests be made with whole bricks, as half bricks should never be used in pavements, and the conditions of the tests should approach as near actual use as possible. Many experimenters use the rattler test for abrasion and impact, pieces of metal large enough to break the brick in pieces being used, but since this method does not even approximate the actual effect of abrasion and impact, only the top side of a brick in place in a pavement being subjected to wear, and the remaining sides being supported, the rattler test would seem to be worthless.

The strength of a specimen will vary greatly with the degree of smoothness of the bed surfaces. Some experimenters grind the pressed surfaces to actual planes, some level up the surfaces by putting on a thin coat of plaster of paris, while others test the bricks in the rough. In order to determine the difference between tests with rough and smooth surface bricks, six bricks of regular form and apparently the same strength were selected, three of which had their surfaces reduced regularly by the use of plaster of paris, which, after hardening, was ground off to a plane, while the remaining three were left in the rough. Both sets of bricks were then tested in a hydraulic press, with cast-iron, parallel, self-adjusting pressing surfaces, and it was found that the average strength of the bricks with plastered surfaces was twice as great as those that were left rough.

Some experimenters test bricks flat, some on the edge and some on the ends. The strength endwise is about half to two-thirds of

the strength flatwise, and the strength edgewise is about three-fourths of the strength flatwise. Therefore from the foregoing, it is easy to see how very indefinite it is to say that the crushing strength of a brick is a certain quantity, unless full details are given of how the tests were made. Some experimenters do not hesitate to say that as a test of the quality of brick or stone, the test for crushing strength is probably worthless. There are some who believe that it is necessary to test the crushing strength, in order to prevent bricks that are too soft from getting into the pavement, but even for this reason, this test seems unnecessary. The crushing strength of a cube cut from a good paving brick is about 8,000 to 10,000 pounds per square inch, and if the pressure is applied on only a portion of the upper surface, the strength is about twice as great. The surface contact of a wheel having a one and one-half inch tire, loaded with half a ton, is roughly about one square inch, which gives a pressure on the brick of only 1,000 pounds per square inch, therefore there seems little danger of the brick becoming crushed.

Definite specifications are an advantage to both parties to the contract, and if they are not used the manufacturer or contractor is placed at the mercy of the individual who has the authority to interpret the contract and inspect the material. If the provisions of the contract are loose, certain contractors will interpret them to suit themselves and make bids figuring that inferior material can be used, while certain others will interpret the provisions to mean that first-class material will be required and will bid accordingly. The most satisfactory specifications the writer has seen are as follows: "The paving brick shall consist of the best quality of sound, hard-burned paving brick, made and burned expressly for street-paving purposes, and shall stand all reasonable tests to which paving material is usually subjected. All bricks shall be square-edged and straight and free from cracks and other defects, and of uniform size and of a quality to be approved by the board of public works. Three or more bricks of the kind or quality of brick proposed to be used shall be furnished with each proposal, said specimens to be labeled with both the bidders' and makers' names and addresses, and must be deposited in the office of the board of public works before the time of opening the bids."

Sometimes a clause is inserted, requiring that the brick used

shall be burned in a particular kind of kiln. This is unfair, as the user of any commodity should simply specify what qualities he desires and leave the manufacturer untrammeled as to his method of securing that quality.

But the foregoing specifications do not specify particularly as to the quality of the bricks to be employed. The fact that a brick is locally known as "the best quality, hard-burned paving brick," is no indication of its quality, as a brick called hard, in one community, may not be so called in another.

During recent years a great difference in the durability of brick pavements has been reported, differing mainly with locality, and it is probable that this difference is due to the difference in the quality of the brick used. It seems impossible, from the description of the brick as usually given, to get a definite idea of the quality of the material employed.

There is one item in specifications for brick pavements which should never be overlooked. The clay from which bricks are frequently made contains limestone pebbles, which on burning are changed into caustic lime. Any considerable amount of lime in paving brick is injurious, since a small quantity of water reaching the lime will cause it to slake and disintegrate the brick. Hence, it should be specified that the paving brick should not contain enough lime to cause it to crack when immersed in water for five or ten days.

The roadway should be excavated to a depth and form sufficient to bring it, when thoroughly compacted, eleven inches below and parallel to the prescribed form of completed pavement. The whole surface should then be rolled with a roller weighing not less than five tons, and any part that can not be reached by the roller should be thoroughly tamped with tampers not less than six inches square at the bottom and weighing not less than thirty pounds. When soft or spongy material is encountered, it should be excavated and refilled with sand, gravel, clay, or other suitable material, which should be tamped in layers four inches thick.

The price per square yard for the paving should include the cost of removing the old curbing and excavating a trench for the new curbing, and the bottom of this trench should be thoroughly compacted by tamping. On the roadbed there should be placed a six-

inch layer of concrete, and in the bottom of the curb trench a four-inch layer of concrete, composed of broken stone, hydraulic cement and sand. Wherever water or gas pipes have been newly laid, an additional layer of cement, six inches thick, should be laid over the ditches in which the pipes are laid. The cement should be of approved quality. The stone should be a good quality stone of the kind in the country where the work is done, but preferably granite or limestone, the greatest dimensions of which should not be over two and one-half inches. The stone should be free from dust and dirt and thoroughly drenched before use.

In a tight box of boards, one part by measure of cement and two parts by measure of sand should be mixed dry. Then there should be added the least quantity of water necessary, and afterwards four or five parts of broken stone, and all thoroughly mixed. This concrete should then be spread upon the road-bed and tamped until the free mortar flushes on the surface. Then thin grout, made in the same proportion as the concrete mortar, should be flushed over the entire surface, and as fast as completed should be protected by a covering of sand and allowed to set at least forty-eight hours before laying the brick upon it. Upon the layer of sand the bricks should be laid on edge, in straight rows, at right angles to the line of the curb, except at street intersections, where they should be laid at an angle of forty-five degrees to line of curbing and with their tops even. The bricks in each row should break joints not less than three inches with those in adjoining rows. None but whole bricks should be used, except where closures have to be made or at the end of the row. Where there are street-car tracks the bricks should be laid close against the rail and be flush with it, then settled into place by rolling or ramming. In laying the bricks, care must be taken to keep the rows straight and close together, and in making closures they should be wedged together and the closures fitted tight in place. After the bricks are laid, they should be evenly settled to a firm bearing in the sand by rolling with a roller weighing not less than one ton per lineal foot of space. No rolling should be done on the pavement nearer than twenty feet from the last bricks laid. After rolling, any broken or badly spalled bricks should be removed and replaced by good whole

bricks, and any bricks which are too high or too low should be raised or lowered to the proper surface.

After the rolling is completed and the surface cleaned of loose material, all interstices should be filled with a good paving pitch, heated to about 300 deg. Fahr., and poured into the joints while smoking hot. Care should be taken to pour the pitch into the joints and not slush it over the surface. After the first pouring has cooled, a second pouring should follow, to fill in any interstices which may not have been filled to the surface. This filling should be done with special care along the gutter lines and next to street-car rails, so as to insure a perfectly water-tight surface.

When the filling of the interstices is completed, the whole roadway surface should be covered with a uniform coat, one-eighth of an inch thick, of good paving pitch, poured on while hot, and immediately covered with clean, coarse, dry, sharp sand. A pavement constructed in accordance with the foregoing description will prove reasonably satisfactory and durable on streets having a travel of not exceeding twenty-five tons per square foot per day. It should, however, be observed that a brick pavement constructed in this manner is not very much less expensive than one constructed of other materials in like good manner. *J. A. Hall, C. E.*

A MUNICIPAL CONTRACT FOR STREET SPRINKLING.

During the session of 1891 of the Indiana Legislature, there was granted to the city of Indianapolis a new charter. This charter created a board of public works, and clothed it with extraordinary powers, one of which was to sprinkle the streets by municipal control, and make the cost thereof a lien upon the real estate along the streets and alleys sprinkled. After conferring with the Water Company, and getting much encouragement—besides the low rate of 8 cents per 1,000 gallons, the Water Company furnishing meters, free water for park frontage, crossings of streets and alleys, and carrying the bills until the tax was collected—the board decided to contract. The board then divided the city into districts, defining them by boundaries, and advertised for bids for each 10,000 square feet; first, three times a day; second, four times

a day, during the season, which was from April 1st to November 1st, a period of seven months. In due time the bids were received, and ranged from $38 to $48 per square of 10,000 feet, for the seven months, at which prices the board entered into contracts. The result of the effort was as follows:

No. of square feet sprinkled	14,899,964	
Gallons of water used	105,515,000	
Gallons per square foot		7.086
Cost of water per square foot		$.000,508

This calculation shows the cost of water per square foot for the season to be about half of a mill.

While the revenue to the Water Company was reduced by many cutting off sprinkling service, the deduction allowed consumers for not sprinkling streets, and the small receipts from the carts, we were satisfied to continue the service again for the season of 1893, the results being as follows:

Square feet sprinkled	17,234,141	
Gallons of water used	138,017,500	
Gallons per square foot, a fraction over		8
Cost of water per square foot		.000,588

Or a little more than half a mill per square foot. A square of 10,000 feet cost $5.88 for water.

The apparent difference in cost occurs from a change made in allowance for parks, streets and alley crossings.

This season we make no allowance for street crossings, alleys, and park frontages.

The cost of labor and water to the lot owner has averaged from 4¾ cents per lineal foot to 7 cents each side of the street. In other words, a lot of 50 feet on a broad street costs for the season $3.50; and a narrow street less than $2.50.

There is no patch sprinkling, and the frontage of vacant lots has been sprinkled as well as the occupied lots.

The result of the experiment has been to give the city freedom from dust and cool streets, thereby contributing much to the comfort and enjoyment of the inhabitants, besides the relief to the animals that bear the burden of the traffic of a great city.

F. A. W. Davis.

Mr. F. A. W. Davis is vice-president and manager of the Indianapolis Water Company, and first vice-president of the American Water Works Association. He is about forty-five years old, has had wide experience in banking and large commercial enterprises. He is generally known as an authority on matters pertaining to the practical management of water-works.

CINCINNATI'S MUNICIPAL PURCHASING AGENCY.*

THERE is perhaps more power centralized in our board than in any board of its kind in the country. We have entire control of no less than eight separate and distinct departments, to wit: our office department, where all of the official business of the board is transacted, and where all improvement legislation must originate; the engineer's department, which controls all construction work pertaining to streets, sewers, bridges, etc.; water-works; health department; street-cleaning and repairing department, and the city infirmary department. My purpose in calling attention to this is the fact that it naturally follows that material and supplies for maintaining these departments in a city as large as Cincinnati must necessarily be very great.

We have recently established what we have termed a general purchasing agency, for the various departments under our control. Heretofore all purchases were made by the head or some subordinate in charge of each department; there was no general system in vogue. A great number of purchases were made without any competition at all, and instances could be cited where purchases were made for no other reason than the fact that the persons from whom the same were made were friendly to the person authorized to make the purchases. Again, because it was simply a matter of favoritism. This agency was temporarily established about six months ago, in order that the practicability of adopting a thorough system in the purchase of supplies and materials of every kind necessary for the operation of the various departments under control of the board could be intelligibly considered and determined before it was permanently established. While only temporary provision was made for this department, it has been demonstrated beyond a doubt that there can be a great saving to the city every year, under a system of this kind, and it has been permanently adopted by us. Certain rules and regulations have been established to govern the department, the more prominent being that the head of each department shall be required to submit to the board a requisition for the supplies necessary for his particular department, and after the same

*Read before the American Association for Municipal Improvement, Sept. 19.

has been approved by the board it is submitted to the purchasing agent, who makes the necessary purchases. He is required to notify all the dealers and manufacturers of any particular article required to submit a proposition, which is opened and read in the presence of the persons bidding. The award must then be made to the person agreeing to furnish its articles at the lowest prices, the preference, however, in all instances being given to home dealers or manufacturers.

We have uniformly endeavored to secure the best quality of supplies at the very cheapest market price, and in many instances have obtained the same quality of goods heretofore used by the department, at much lower figures. As far as can be learned we have not exceeded in any instance the prices paid before this agency was established.

It is difficult to make comparisons and show figures, except in the purchase of staple articles, the prices of which are more or less fixed. However, we think that the following figures will show that the system will give general satisfaction.

In the case of the purchase of one car load of stone for sewer inlets, the stone was purchased according to the specifications, at a saving of $66.40 to the city over former prices, the total of the purchase being $357.

As late as April and May, brick was bought for the prices ranging from $9 to $9.95 per thousand. We are now getting the same brick from the same man for $8.25 per thousand, a saving of $37.50 on the first order of fifty thousand.

In May, 1894, the departments were paying $1.05 per barrel for Black Diamond Cement, which is now being bought in large and small lots at 80 cents per barrel, a saving of nearly 25 per cent. On Giant Portland Cement, and other brands, 40 cents per barrel was saved.

The greatest saving has probably been in the purchase of sewer-pipe; it has averaged 40 per cent., and during the month of June, more than paid the expenses of the Purchasing Department.

In the purchase of white lead, of which the department use large quantities, this department, by inviting competition, makes a good showing. Vouchers show that 7 cents a pound has been paid for white lead, while we have been getting it for 5¼ cents.

It is hard to specify as to the prices for the smaller articles, which we have purchased in small quantities, but it is our belief that we have averaged a saving of 15 per cent. on all our purchases, not including these staple commodities, such as sugar, flour, hay and oats; which are sold at the ruling market price.

In the matter of printing we make a particularly good showing.

Brooms which have been bought at $6 per dozen were bought for $2.50, and the same person who has been selling them at $6 has offered to furnish the same broom for $3. So much for competition.

In the matter of rubber and hemp packing, there is also a great saving, we having secured for 43 cents per pound the same material that formerly cost 60 cents per pound.

A number of other examples might be cited, all of which have been brought about by inviting active competition.

We commend this idea to all cities not having it in vogue. In Cincinnati, the purchases made by this agency will amount to $500,000 a year, and the figures before us will show that there can be a uniform saving of fifteen per cent. as compared with the old system.

Aug. Herrmann,
President Cincinnati Board of Administration.

MALTHA AS A FLUX FOR ASPHALTIC PAVEMENT.

On June 27, 1854, Abraham Gesner received three patents for "an improvement in kerosene burning-fluids." In the preamble to his specification he says: "I obtain this product from petroleum, *maltha*, or soft mineral pitch, asphaltum or bitumen." * * * In various works on mineralogy of about this date maltha is described as "mineral tar." The word was used by Pliny to describe an inflammable mud from Asia Minor. It was also used in early Roman and Grecian times to designate the wax tablets used in writing. It has never been used, however, in the present century to designate anything but mineral tar, to my knowledge. When properly used the word can only mean mineral tar, and with that meaning it now enters the vocabularies of most modern languages.

It is with this meaning that I now intend to use it, and not as synonymous with any form of crude petroleum, no matter how dense it may be; for, maltha and petroleum are two distinct forms of bitumen, and while in nature the former may in some instances pass into the latter, in other instances it can not.

I have explained elsewhere how this change is probably brought about,[1] through the decomposition of the nitrogen compounds of the petroleum, and the precipitation within the oil of the acid radicals as hydrates, that in the natural state are soluble in the remainder of the petroleum and are very viscous. These hydrates carry with them an amount of water equal, on a general average, to twelve and one-half per cent. of the whole amount of the maltha. This water will not settle out nor can it be removed from the maltha, at any moderate temperature, but must be expelled at or above 212° Fahr. The maltha also contains either air, carbon dioxide or hydrogen sulphide in varying proportion mechanically mingled with the viscous mass; so that when the maltha is heated to not more than 100° Fahr., it begins to froth rapidly and will usually fill both still, condenser and receiver, with an overflow of foam before any of the water has been removed. These statements represent facts well known to every one who is at all familiar with maltha or mineral tar.

When maltha is heated in vessels of sufficient size to allow the foam to rise and subside, the water may be boiled off together with the small amount of volatile oils that are always present in natural bitumens in varying amount. There remains in the vessel a dense viscid residuum. When petroleum, and particularly any variety of petroleum that in nature, under proper conditions, would form asphaltum, is distilled in such a manner that the more volatile constituents—for instance, those volatile under 300° Fahr.—are removed, a residuum remains in the still that resembles in many respects crude maltha, but in others is quite different. In color, specific gravity, and viscosity, they may be identical, but the petroleum residuum will not contain either gas, water, or volatile oils, as is the case with the natural maltha.

It is manifest that the residuum of either maltha or petroleum is not maltha; but I think no clear distinction is at present being

[1] American Journal of Science, September, 1894.

made, by some writers upon this subject, between them. It is equally clear that when a proper flux for paving cement is being sought, these two classes of substances should not be confounded.

There are several additional fallacies constantly intruding upon the proper discussion of this subject that must be clearly distinguished. By some it is held that heavy petroleum and maltha are interchangeable terms. I have already shown that they are distinct substances, and neither of them is suitable for use as an asphaltic flux because they contain a certain notable proportion of volatile oils, that renders either of them dangerous for use in the open kettles of the street-paving plant; besides being, in addition, a positive injury to the pavement and a source of waste in the process of construction. It is also held by some others that if petroleum or maltha are heated sufficiently to remove the objectionable volatile oils—say to 300° Fahr.—that they are thereby rendered unsuitable for use as a fluxing material. This opinion is also a fallacy. A sure indication of the overheating of any fluid bitumen is the conversion of a portion of it by cracking into a substance insoluble in petroleum ether and other similar solvents. Technically this substance is known as asphaltine. Precisely what this conversion means as an exponent in the asphalt paving problem is at present not well understood by any one. At any rate, if any of the most prominent writers at present discussing the subject do understand what it means, they have not thus far made any explanation. Miss Laura Linton has lately communicated to me the results of a research that show that, as hitherto interpreted, in the chemistry of asphaltums and alphaltic residues, it means very little. Yet, I think after further investigation it may be made to mean a great deal. Natural malthas, before they have been heated at all artificially, contain in considerable quantity a substance insoluble in petroleum ether. That being the case, the question arises, to what point shall we proceed in using this test to determine whether or not a given material is suitable for use as an asphaltic flux? I have just completed an examination of a maltha residuum, a petroleum residuum, and two natural malthas, with the following results: No. 1 is a maltha residuum prepared for fluxing asphaltum; No. 2 is a petroleum residuum, prepared by the Union Oil Company of California, to be used as a flux for asphaltum; No. 3 is a

maltha, from a well at Summerland, on the coast below Santa Barbara; No. 4 is a crude maltha from near Los Angeles. No. 1 is too dense to admit of the specific gravity being taken with hydrometer, but it can not be far from 10° Beaumè; No. 2 has a specific gravity of 17° Beaumè; Nos. 3 and 4 have a specific gravity of about 14° Beaumè. The petroleum ether used in these experiments was brought from Chicago.

No.	INSOLUBLE IN PETROLEUM ETHER (PARAFFINES).	WATER.
1	18.35 per cent.	None.
2	4.63 " "	None.
3	4.295 " "	Present but not estimated.
4	5.937 " "	Present but not estimated.

Whatever else the percentage of material insoluble in petroleum ether may or may not indicate, it is certain that it shows how far the change has progressed that carries the petroleum through maltha to asphaltum, either by the operation of natural causes or by the aid of heat. Judged by this standard it is clear that a dense maltha residuum that has been heated sufficiently to deprive it of its water and air is too nearly asphaltum to be valuable as a flux for asphaltum.

Another fallacy lies in the frequent use that is made of the term "liquid asphalt." Language is at best an imperfect medium for communicating thought. In the use of language names are given to things. For years the history and nomenclature of bitumen have been confused by calling maltha heavy petroleum. Lately it has become a sort of fad in certain quarters to use this term, "liquid asphaltum." Asphaltum is the solid form of bitumen, and can not be a liquid any more easily than petroleum can be solid. One might just as sensibly speak of "solid petroleum," when discussing paraffine. In nature "liquid asphalt" is maltha, in technology it is a residuum from either petroleum or maltha. It may be suitable as a flux for asphaltum, not because it is called by any particular name, but because it possesses the properties desirable in such a substance.

I have elsewhere very fully discussed the properties required in

a suitable asphaltic flux.[1] In general terms it may be said to be a liquid bitumen that will dissolve asphaltum, having been deprived of all material volatile under 300° Fahr. It should also be as fluid as possible, in order that the greatest softening effect may be produced by the least quantity. No softening or fluxing effect can be derived from the asphaltine insoluble in petroleum ether, contained in either of the materials that I have examined. On the contrary, a certain additional quantity of the petroline or liquid portion of the bitumen is required to bring this dry powder into a plastic condition. It may be safely estimated that from twenty to twenty-five per cent. of this "liquid asphalt" (No. 1) is not a flux at all, but is simply asphaltum that is added to the other asphaltum used. In the case of the flux prepared by the Union Oil Co., of California, not more than six per cent. of the one hundred per cent. that is soluble in carbon di-sulphide would fail to act as a flux for the asphaltum to which it is added.

I believe that no asphaltic flux has ever been put upon the market, equal in all respects in quality and that can be so economically used as the "Reduced Petroleum," manufactured from the petroleums convertible into asphaltum," which are a perfect solvent for asphaltum, that are produced in the vicinity of Santa Paula, Ventura county, California. *S. F. Peckham.*

HOT BATH TESTS FOR CEMENTS.*

ALL hot tests are discarded in the German standards for the reason that they have been found misleading. The German opinions upon this subject should be given great weight, because of their very thorough practical tests and from the fact that their cements will universally stand the hot tests; and that, therefore, their opinion may be taken as unbiased.

The writers have been making observations with hot tests for more than a year at the temperature of 180 degrees Fahr. in most cases. The first impression from these tests is that they are convincing as to their value, as there is such a sharp contrast between

[1]American Journal of Science, Jan., 1894. Paving, Aug., 1894.

*Abstract of paper read before the American Society of Civil Engineers, Sept. 5.

those pats which come out sound from the test and those which show different grades of deterioration.

Experiments with lime have convinced the authors that free lime is somewhat of a "bug-a-boo." It is quite true that the addition of caustic lime in moderate proportion will produce swelling in pats placed in hot water baths; but if hard burned lime is ground to pass through a No. 74 sieve it soon ceases to be caustic; it rapidly takes up water from the air, and it is probable that in a week or ten days after grinding, the free lime contained in a cement has ceased to be caustic. Thoroughly hydrated lime is of no disadvantage to cement; on the contrary, the strongest sand mortars are made of mixtures of well-slacked lime and Portland cement. Thus a mortar of two-thirds Portland cement and one-third slacked lime, mixed with two parts sand, gave tensile strength of 423 pounds in seven days, and 583 pounds in twenty-eight days. Pats of this mixture stood boiling tests perfectly, whether fresh or salt water was used. The mixture of finely ground lime with cement is for the purpose of giving greater plasticity to the mortar.

Cements are made slow-setting at will by the addition of sulphate of lime, and such cements will in most cases stand boiling. Several brands of English and American Portland cements which would not stand boiling tests when received, did so when made slow-setting by the addition of lime. Not only is it true that they frequently can be made slow-setting, but they will carry through the hot test a considerable added percentage of lime.

A Portland cement, which would not boil satisfactorily, gave on a seven-day test an average strength of 464 pounds. It was then rendered slow-setting by adding 10 per cent. of quick lime as dry powder, and two briquettes were made from it. These swelled and developed cracks in the molds, but after setting 24 hours they were put in hot water at 180 degrees Fahr. for 48 hours, when they gave respectively 460 and 500 pounds strength, with no further development of cracks.

In another case, cement which gave 488 pounds on seven-day tests had 3 per cent. of specially calcined quick lime added. The briquettes were hard and sound, and after 24 hours were put in hot water at 180 degrees Fahr., and kept there for 48 hours. They then gave 559 to 598 pounds per square inch strength.

Another portion of this cement had 10 per cent. of such lime added, which had been ground fine and kept in a box for a week. Briquettes kept one day in air and six days in water gave 446 pounds to 506 pounds strength. When kept in water 48 hours they gave from 416 to 421 pounds. There were a few small cracks on top, which did not change after two months' exposure in the air.

It is evident from these cases that hot-bath tests do not reveal the presence of free lime in such cements. The Germans reason evidently that a quick-setting cement will either be able to deal with its content of free lime in ordinary course, or else its failure to do so will be manifested in cold water after a lapse of a few days. As a test of free lime, the high-temperature bath has not commended itself to the writers. Some cements are quite disintegrated in the hot bath, and one or two have failed to be entirely satisfactory when made slow-setting. Analyses have showed these samples to contain high percentages of anhydrous sulphate of lime, which were burned with the cement.

French specifications limit this anhydrous sulphate, and there is an endeavor to keep it out of the product. While the hydrous sulphate which is added to cement after burning is not at all injurious in small percentages, the presumption is that anhydrous sulphate is, and the writers assume that very bad pats are due to anhydrous sulphate. So far the facts have confirmed this hypothesis, and a further investigation may lead to interesting results.

Frederick J. Lewis.
J. Edward Whitfield.

MUNICIPAL OWNERSHIP OF SUBWAYS.

Is it reasonable to require the placing of wires underground; and if reasonable, who shall own the conduit in which they are placed? Is each company to have its own, or one company construct the necessary conduit and lease space to the various companies? Or shall the municipalities assume the position of landlords?

In answer to the first question, as to whether it is reasonable to ask a company to bury its wires, allow me to say that the chief of the electrical bureau of the city of Chicago has repeatedly stated,

over his signature, that the city of Chicago maintains 1,100 arc lamps of 2,000 candle-power each, which burn every night and all night, and that the cost does not exceed 19 cents per lamp per night. In that city every inch of this arc light city wire is underground in conduits owned and maintained by the city. Compare this with 40 cents per night, which is paid by the city of Boston for the same class of service, with all the wire overhead, and I think the question of the economy of underground construction is settled.

The telephone company has acknowledged that it is better for them to bury their wires, by voluntarily doing so.

The important question for us to consider is whether it is necessary that each company operating wires shall build its own subway, or whether all wires could be safely operated in one.

From the standpoint of superintendents of streets, I have no question you would unanimously vote for one conduit, if the same were practicable. No one questions for a moment that it is perfectly safe to operate all kinds of telephone and telegraph wires, which are commonly called low tension wires, in one conduit. But when the question comes, can we safely place high tension wires in the same subway, a very important addition is made to the question. Theoretically, there are difficulties in the way. But after years of practical success in the cities of New York, Chicago and Philadelphia, where the cities have low tension wires in the same conduit with high tension wires, it certainly seems that the theorist who claims this can not be done must acknowledge that it is practically a success.

Prof. Barrett, city electrician of the city of Chicago, who has had the largest experience in underground construction of any man in this country, is an advocate of municipal ownership of subways, and is positive in his assertion that it is perfectly safe and practicable to operate all kinds of wires in different ducts in the same subway.

It is but natural that each company should prefer to own its own conduits, as this gives to them franchise rights of great value, which are practically perpetual. And with the telephone companies, the ownership of their conduits means, of course, the perpetuation of their monopoly, as at the expiration of their patents all the princi-

pal streets in our cities would be provided with telephone conduits, and the people would not be willing to have the streets torn up for the admission of a competing company. If, however, the conduits were owned by the municipality or a conduit company, space could be leased to individuals for private line instruments, and if thought best, to a competing telephone company. Therefore, I think you will readily see the motive which induces the telephone company to fight this proposition to the bitter end.

The question of municipal ownership of electric light plants is being vigorously discussed, and there is no doubt that many of our large cities will operate their own plants within a comparatively few years. And it would be very much to their advantage to own the subways for their wires, and have a right to require the telephone and telegraph companies and the railway companies to operate their wires in this city subway, at a fair rental.

Thus from an economic standpoint, we would all agree that for a medium-sized conduit it would be better to have this joint occupancy, with separate manholes for high and low tension wires, and only one trench.

As the citizens are to pay the interest on the money invested by all of these corporations, they have the right to demand that the work should be done in the most economic manner.

As to street men, I feel sure that I need not enlarge upon the advantages of municipal control of our streets, which, under existing laws, is gradually being taken away from the municipalities.

In conclusion, I would say that the question to be considered has resolved itself into one of three methods. Shall each company be allowed to construct its own subway, which would make in some streets in the city of Boston eight different subways, as is now the case in one street in Philadelphia? Or shall the right be given to a corporation to construct one or two subways and lease space to the various companies? Or shall the municipality, for the sake of the control of its own streets, construct these subways and lease space to the companies? *C. H. Morse.*

CURRENT INFORMATION.

FIRST MEETING OF THE AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS.

In response to the call for a conference of members of boards of public works, and city officials in charge of public improvements, published in the August number of PAVING AND MUNICIPAL ENGINEERING, representatives of sixteen cities met at Buffalo on September 19th. The movement which brought them together was started several months ago by Mr. M. J. Murphy, street commissioner of St. Louis. The following named public officials were in attendance at the meeting:

St. Louis—Robert E. McMath, president board of public improvements; R. R. Southard, sewer commissioner.

New Bedford, Mass.—S. C. Hathaway, commissioner; A. B. Drake, superintendent of streets.

Camden, N.J.—John Blowe, street commissioner; L. E. Farnham, city engineer.

Omaha—J. H. Winspear, chairman board of public works; St. A. D. Balcombe, sewer commissioner; Frank J. Kasper, street commissioner.

Indianapolis—A. Kramer, commissioner board of public works.

Memphis—P. C. Powers, street commissioner.

Syracuse—H. B. Johnson, commissioner of public works.

Newark, N.J.—A. Jorlmann, commissioner; H. Van Duyne, chairman board of public works.

Portland, Me.—G. N. Fenald, city engineer.

New Haven—J. B. Sargent, mayor; J. W. States, president board of public works; William Maley, J. E. McGann, James Bishop, commissioners; C. W. Kelley, city engineer; P. Doyle, superintendent of streets.

Allegheny, Pa.—D. L. Fulton, superintendent of highways and sewers.

Grand Rapids, Mich.—F. E. Latelier, president; J. J. McVeane, commissioner; H. A. Collar, city engineer.

Ft. Wayne, Ind.—T. D. DeVillais, chairman board of public works; F. M. Randall, city engineer; G. H. Loesch, W. Tigar, H. Michael, C. Gribel, P. Wolf, P. J. Sheld, B. Barkenstern, councilmen; A. Fwelber, O. L. Drummond, newspaper men; Willis Hatterly, F. J. Miller, George Riter, special committee.

Milwaukee—G. H. Benzenburg, city engineer; E. M. Scheingel, secretary; F. Sebneider, S. Brockman, commissioners of public works.

Cincinnati—Aug. Hermann, Geo. G. Steritt, John B. Washburn, John Frey, board of administration; D. W. Brown, city auditor, H. J. Stanley, city engineer.

Buffalo—Commissioners Geo. S. Field, Geo. S. Gatchell and James Mooney; City Engineer Guthrie.

The convention was called to order by R. R. Hefford, chairman of the citizens' reception committee, of Buffalo. On motion of a St. Louis member, Mr. George S. Gatchell, commissioner of public works of Buffalo, was unanimously elected president of the new organization. Mr. Gatchell said the honor belonged to Mr. Robert E. McMath,

to whom was due the credit of calling the convention. Mr. McMath was accordingly elected president. Mr. R. G. Parsons was made temporary secretary.

The delegates to the convention were welcomed by Mayor Bishop of Buffalo. The purpose of the assemblage was to form, as nearly as possible, a permanent organization of members of boards of public works for mutual instruction and the interchange of ideas pertaining to the government of cities.

A committee was appointed on permanent organization, to draft a constitution and by-laws, as follows: George H. Benzenberg, Milwaukee; F. E. Latelier, Grand Rapids, Mich.; D. L. Fulton, Allegheny, Pa.; James W. States, New Haven, Conn.; T. D. De Villais, Fort Wayne; G. N. Fennell, Portland, Me.; H. B. Johnson, Syracuse; A. J. Jorlmann, Newark, N. J.; P. C. Powers, Memphis, Tenn.; Andrew Kramer, Indianapolis; J. H. Winspear, Omaha, Neb.; John Blowe, Camden, N. J.; R. R. Southard, St. Louis, Mo.; S. C. Hathaway, New Bedford, Mass.; George S. Gatchell, Buffalo.

Chairman Benzenberg reported that the committee had decided to recommend the formation of a permanent organization composed of the members of boards of public works and officers having charge or supervision of public improvements.

Secretary Fulton read the formal report from which it appeared that the name suggested was "The American Society for Municipal Improvements." Its objects were said to be to promote and circulate information on the best methods to be employed in the construction of municipal works, to hold annual conventions for mutual intercourse, read and discuss papers, and issue an annual publication.

The membership is to include municipalities throughout the country and officers charged with the supervision of municipal works. The initiation fee is $5 for each municipality for each delegate, and $5 for each eligible individual. The dues are to be $3 per annum, payable on or before the date of the annual meeting.

The officers are to be a president, first vice-president, secretary and treasurer, who shall act as an executive committee. These officers will hereafter be elected on the second day of each annual convention, and each municipality will be entitled to as many votes as it has eligible members present. This does away with proxy voting. The annual meetings are to be held on the second Wednesday in September of each year.

The constitution and by-laws having been adopted section by section, Mr. Benzenberg moved later on to appoint a committee of five to draft a more complete set of articles and by-laws to be acted on at the next annual meeting.

The election of officers resulted as follows: President, M. J. Murphy, of St. Louis; first vice-president, G. H. Benzenberg, Milwaukee; second vice-president, George S. Gatchell, Buffalo; secretary, D. L. Fulton, Allegheny, Pa.; treasurer, A. Jorlmann, Newark, N. J.

Cincinnati was chosen as the meeting place for next year.

Reports from the different cities as to their public work were called for in alphabetical order. Secretary Fulton, who represented Allegheny, told of his city having sanctioned a bond issue to the amount of $1,000,000 for repaving its streets. They favor sheet asphalt, and will

use fire brick on some streets not much traveled.

Gen. George S. Field was questioned at considerable length concerning Buffalo and its improvements, regarding which a small pamphlet was circulated among the delegates. Some of the delegates desired to know a good deal about the cost of asphalt and its repairs, and how it is paid for. In reply to a question as to whether Buffalo thought of establishing a plant for the purpose of doing its own paving, Gen. Field did not deem that advisable where the cost of repairs did not amount to $75,000 or $100,000. At present the repairs were estimated at six cents a square yard. Others were much interested in Buffalo's system of collecting and destroying garbage, its disposal of ashes, and method of cleaning the streets generally.

Camden, Cincinnati, Grand Rapids, Indianapolis, and Milwaukee were reported on in turn. Mr. Benzenberg had a good deal to say about the corrosive action of electricity in conjunction with chemical salts on water mains underground.

The second day was occupied with a lake excursion and a trip to Niagara Falls, in addition to which the delegates to the meeting were taken on a carriage drive through the city and were given an exhibition of great work by the Buffalo fire department. The entertainment provided by the city was greatly appreciated by visitors, and the city was generously praised by them.

THE EXPERIMENT WITH PAVING BRICK IN CHICAGO.

The vitrified brick pavement laid as a sample on the east side of La Salle street, Chicago, by the Purington Paving Brick Company, of Galesburg, Ill., seems to meet the needs of the public in giving it a pavement that is at once noiseless and durable. It has been said of the wooden block pavements of Chicago that it would be just as well to have chunks of ice cut in the winter and use them for a pavement, for they would last through the winter and that is about the life of a street paved with wooden blocks. The city has 648 miles of streets paved with this material, and the yearly expenditure for repairs has been enormous. For this and various similar reasons the pavement recently laid will be observed with great interest.

John McCarthy, superintendent of streets, said: "I have the highest opinion of brick paving and was in favor of having it laid on La Salle street that the people might judge for themselves. I have given the subject considerable thought and examined brick pavements in other cities. I found that it gave complete satisfaction. It has been proven that it can stand the heaviest kind of traffic. Another thing in favor of brick pavement is that it is always clean. It also gives a good footing for horses. It is cheaper than asphalt and granite. The tearing up of streets, which is continually being done, can more easily be repaired by brick than by any other pavement. From the annual report of Eastern cities it will be seen that brick is rapidly becoming the street pavement.

S. S. Kimball, general manager of the Hydraulic Press Brick Company, said: "I have seen brick paving in the different cities of the United States, and it has uniformly given splendid satisfaction. Small brick makes the best paving. La Salle street is a good example. Small brick can be laid closer together, making it more compact and less liable to get out of repair.

In winter when other streets are slippery horses can obtain good footing. To sum it up, brick is my ideal of a pavement."

B. J. Moore, president of the Western Stone Company, said: "I think well of brick paving for heavy traffic, and for general use it is just the thing. We have used brick paving in our yards and it has stood the incessant heavy traffic without the least undesirable effect; our trucks are of the heaviest character and rarely carry less than five tons, so you will readily see that a pavement standing this kind of traffic is a good one. There is no doubt about its splendid lasting qualities. It does not seem possible that brick would stand such abuse, but it does, and comes out without a flaw. I think with the same amount of traffic it will stand twenty years more. I am very much in favor of it for general use, and think the time will come when brick will be the standard pavement."

J. H. Shepard, of Dolese & Shepard, said: "I am in favor of brick pavements when good brick are used. The city should be careful in demanding the best quality of brick. That, to my notion, is the most important matter in brick paving. I am satisfied that for general use brick will give the best satisfaction. It is steadily coming to the front for streets and alleys, and I think there is a big field for it."

CEMENT AND PAVING BRICK IN CANADA.

A. Blue director of mines, of Canada, in a recent address to the Ontario Mining Institute, spoke at length on the importance of the working of clay and lime in Ontario. They were deserving, he said, of much greater attention than they had yet received. From 1880 to 1890 the manufacture of cement in Canada had increased from $91,658 to $251,175. The whole of this product was consumed at home, but it was far from supplying the needs, hydraulic cements having been imported in 1890 to the value of $313,690. In Toronto during the last five years not less than 150,000 barrels of cement had been used in making concrete for street construction, and of this quantity only 4,000 barrels had been native cement. There was, he urged, no reason why they should have to go abroad for Portland cement. In Ontario they had an abundance of raw material for producing it.

Alluding to the clay industry, Director Blue referred to the manufacture of vitrified brick for street paving, which was now, he said, on the eve of commencement. If successfully established, it promised to be a great boon to towns and cities. In various American states the industry was one of great importance, supplying a material for street construction which on all points of merit was not equaled by any other material hitherto employed. Many mistakes were committed by the first makers of paving brick, but much had since been learned, and with careful experiments many works were enabled to produce with regularity a high percentage of paving brick. In several instances encouraging progress had been made, and he believed there would be an early beginning of the production of paving brick in Ontario.

CANAL FROM LAKE HURON TO BLACK RIVER.

Mr. F. F. Rogers, the city engineer of Port Huron, is making surveys and borings to determine the most practicable route for a canal from Lake Huron to Black river.

Black river is a sluggish stream

flowing through the center of the city and into St. Clair river, about two miles south of Lake Huron and below the rapids. It has been used for the outlet of the principal sewers of Port Huron, and has a pulp factory located on its banks about a mile above the city, which discharges large quantities of sulphuric acid into its contaminated waters. The action of the acid on the vegetable matter in the river produces an odor which is very offensive (though apparently not unhealthy), hence the demand for some means of purifying Black river. This canal has always been considered the most feasible of the different plans proposed, as the surface of Lake Huron, during the dry summer months, has an elevation of 1 3-10 feet above the water in Black river, and is distant only 6,700 feet. The average height of the land above Lake Huron is 20 feet, and the greatest height is 31 feet. The soil is sand, muck and clay. There seems to be no serious difficulty in the way of opening a canal sufficiently large to purify Black river in the summer months, if the city is willing to spend the money needed to make the cut.

A PROPOSED PAVING BRICK TRUST.

An attempt was made to organize the Interstate Paving Brick Association at Cleveland on September 18. It is intended to be a paving brick trust composed of manufacturers in Pennsylvania and several in Ohio. The call for the meeting stated, "It must now be evident to all paving-brick manufacturers in Western Pennsylvania and Eastern Ohio that the prevailing prices mean ruin to the business. The same forces which have brought us to where we are are still at work, viz., excessive competition among ourselves. There is no reason why we should not stand together for self-protection as the manufacturers of all other lines do. The effect of such close competition is not only that we have to work gratis for the public, but, in order to meet the prices there is great temptation to lower the standard of quality—which, in the end, means that the enviable prestige which brick has gained will be lost, in favor of some other kind of pavement." At the preliminary conference a committee of five drafted a plan for organization which was submitted but not definitely decided upon. The name of the organization, according to the report, was to be the Interstate Paving Brick Association. Outside of detailed arrangements for the organic constitution of the association, provision was made in the suggested plan that a committee of five should be established to grade the brick put out at the different factories. All paving brick produced at factories operated by members of the association are to be sold by the association according to this standard. An executive committee, according to the embryo scheme, is to determine from time to time the prices at which brick shall be sold on board the cars at the works. The committee will also determine the price at which the association shall take the product of its members. The profits, that is, the margin between the factory price and the market price, shall be prorated among the members of the association according to the interest of each. The duration of the association is to be ten years and its membership shall be by factories, each factory having a vote for each 1,000 brick daily capacity of ten

hours' run. Among those present at the meeting were: Charles J. Deckman and John Gaus, Malvern, O.; J. P. Hole, Damascus, O.; I. N. Penrock, Minerva, O.; T. F. Galey, Beaver, Pa.; N. I. Shugech, Rochester, Pa.; A. Stewart, West Bridgewater, Pa.; M. S. Marquis, New Castle, Pa.; John S. McNutt, Wellsville, O.; T. L. Kennedy, New Brighton, Pa.; George Brighton, Franklin, Pa. The temporary officers are: President, T. L. Kennedy, New Brighton, Pa.; secretary, John S. McNutt, Wellsville, O.; treasurer, M. S. Marquis, New Castle, Pa.

The meeting closed without the consummation of the project. Why it did not go through was not announced, other than that a larger per cent. of the manufacturers was desired before permanency was given to the combination. A secretary was elected in the person of Commodore W. J. Konntz, of Allegheny, Pa., whose duty it is to further agitate the subject. No date for a subsequent meeting was fixed, the right being given the secretary to call one when he deemed best.

PAVING BRICK IN THE SOUTH.

The Vicksburg (Miss.) *News* quotes a civil engineer as advising the use of vitrified brick in paving the streets of that city, and says:

He believes that even their use on the steep inclines of the streets leading to the river would save their increased cost quicker than on the more level surfaces. Laid in diagonal lines across, on a proper foundation, with a half or three-quarters of an inch space between them, the interstices or spaces filled with a compound of sand, gravel and coal tar, would give a better, surer footing for animals than gravel. At present, the gravel is ground up into a most annoying dust, filled with tenacious, adhering, cutting particles that are greatly dreaded by those who suffer from the infliction. Gravel quickly cuts the plating and polish from all silvered or metal surfaces, scratches and defaces plate-glass in windows and show cases with unerring certainty, and renders any merchandise that is allowed to come in contact with it useless except for the bargain counters. Paving brick can be made here which are unequaled for hardness and at a minimum price that will give the city the easiest, most durable pavement at present known."

NEW YORK CITY'S INCOME FROM STREET RAILWAY FRANCHISES.

Comptroller Fitch, of New York city, says there is no uniform rule regarding the amount paid to the municipality by the street car companies. Some companies are bound by stipulations entered into upon the city granting them additional privileges; some are subject to the municipal ordinances providing for car license fees, and the very recently incorporated companies come under the provisions of the general railroad law of the state. A statement prepared by Comptroller Fitch shows that since 1880 the amounts paid to the city are as follows:

Broadway and Seventh Avenue and Broadway Surface Railroad—From 1885 to 1890 this company paid the city three per cent. of its gross receipts, and $50 per annum license fee for each car. From 1890 to 1893 it paid five per cent of gross receipts, $50 per car, and $40,000 per annum, stipulated sum. From 1893 it paid five per cent. of gross receipts, not to be less than $150,000 per annum, and $50 per car.

Sixth Avenue Railroad Company—Fifty dollars per car per annum since 1889.

Chambers and Grand Street Ferry Railroad—Three per cent. from 1887 to 1891, and five per cent. with $50 car fee since 1891.

Central Cross-town Railway Company—Three per cent. of its gross receipts from 1887 to 1893.

Central Park, North and East River Railroad Company—Fifty dollars per car per annum since 1886.

Ninth Avenue Railroad Company—Fifty dollars per car since 1889.

Second Avenue Railroad—Five per cent. of gross receipts from 1890, and one-third of one per cent. on certain extensions.

Third Avenue Railroad—Twenty dollar car fee from 1886 to 1893.

Twenty-third Street Railroad—Five per cent. of gross receipts from 1890.

Twenty-third Street Railway—One per cent. of gross receipts from 1891, and $50 for large cars, and $25 for small cars.

North and East River Railroad Company—Sold at auction for 38 per cent. gross receipts; unable to make payments; now operated by contractor.

Hudson River Railroad Company—Dummies $50 per year each.

New York Elevated Railroad——Five per cent. of net proceeds; has paid nothing since 1890. The Court of Appeals has decided that the city can recover five per cent. of the net income only on passenger traffic on the Ninth avenue line from Greenwich to Sixty-first street, and two and a half per cent. from Sixty-first to Eighty-third street.

Christopher and Tenth Street Railroad—Three per cent. of gross receipts since 1888.

Dry Dock, East Broadway and Battery Railroad—Five per cent. of net proceeds, $50 each for large cars, $25 for small cars since 1888.

Eighth Avenue Railroad—Fifty dollars per car per year since 1882.

Forty-second Street and Grand Street Ferry Railroad—Fifty dollars per car since 1888.

Forty-second Street and Manhattanville and St. Nicholas Avenue Railroad—Three per cent. of gross receipts from 1885 to 1891, and five per cent. from 1891.

Houston, West Street and Pavonia Ferry Railroad—One thousand dollars per annum stipulated sum and $50 for each car.

New York and Harlem Railroad—three per cent. on gross receipts of extensions from 1885 to 1893.

Twenty-eighth and Twenty-ninth Street Railroad Company—Not completed. To pay three per cent. on gross receipts the first five years and five per cent. thereafter, to which add 29 2-10 per cent. bid at time of sale.

Metropolitan Cross-town line—Six per cent. on gross receipts and $50 per car from 1891.

Union Railway Company—One per cent. of gross receipts when the average reaches $1,700 per day. Has paid nothing in two years.

MEETING OF AMERICAN STREET RAILWAY ASSOCIATION.

The thirteenth annual meeting of the American Street Railway Association will be held in the City of Atlanta, Ga., October 17 to 19, 1894. The subjects to be discussed and the committees appointed to report thereon are as follows:

"Can the T Rail be Satisfactorily Used in Paved Streets?" Joel Hurt, president Atlanta Consolidated Street Railway Company, Atlanta, Ga.; S. Hendrie, manager Wyandotte and Detroit River Railway Company, Detroit, Mich.; H.

J. Crowley, engineer Atlanta Consolidated Street Railway, Atlanta, Ga.

"City and Suburban Electric Railways." Elwin C. Foster, superintendent Lynn and Boston Railroad, Boston, Mass.

"Mail, Express and Freight Service on the Street Railway Cars." Richard McCulloch, electrical engineer Citizens' Railway, St. Louis, Mo.

"The Best Method of Treating Accidents and Complaints." John B. Parsons, general manager West Chicago Street Railroad Company, Chicago, Ill.

"Street Car Wheels and Axles." D. S. Cook, electrical engineer Trenton Passenger Railway Company, Trenton, N. J.

"Transfer and Commutation." Rodney Curtis, president Denver Tramway Company, Denver, Colo.

"The T Rail Construction of the Terre Haute Street Railway, Company." M. F. Burke, superintendent Terre Haute Street Railway Company, Terre Haute, Ind.

"A Standard Form for Accounts for Street Railways." H. I. Bettis, consulting engineer Atlanta Consolidated Street Railway Company, Atlanta, Ga.

THE OLD WESTERN BOULEVARD IN NEW YORK.

The continuation of the old Western boulevard along the extreme western edge of Fort Washington Ridge will soon be one of the finest and most attractive drives in New York City. The road was planned several years ago, but the contract for its improvement was not let until about two years ago. It will add three miles to the length of the old Western boulevard. Two miles and a half of the new road have been completed and the work is making rapid progress.

VERMONT'S MACADAM ROAD.

Two state roads of macadam have been suggested as an instructive object lesson for Vermont, which would probably in time lead to a first-class system of roads throughout the state. Under the present system the state has no permanent, substantial roads and it is unlikely that it will have unless the legislature adopts some such plan as has been suggested.

STREET PAVING IN DULUTH.

The members of the board of public works of Duluth, Minn., who recently made a visit to St. Paul and Minneapolis to inspect their street paving, were impressed with the durability of asphalt as a paving material. They think that, while asphalt would cost from one-half to two-thirds more than Duluth concrete and cedar block, in the long run it would cost less and give better satisfaction.

KANSAS CITY PAVING BRICK TESTS.

The schedule of tests to which brick for street paving will be subjected hereafter, at Kansas City, Mo., has been completed by City Engineer Filley, and is as follows: Specific gravity test—Each brick must weigh 2 1-10 times as much as the water displaced by it. Absorption test—The brick must absorb 3 per cent. of their weight when dried at a temperature of 212° and immersed in water for forty-eight hours. The brick must be free from lime and show no signs of cracking when left in water for ninety-six hours. Rattler test—Ten brick will be placed in a foundry rattler with 300 pounds of small, irregular pieces of cast iron and revolved from twenty-two to twenty-five times per minute. The brick must not lose over 7 per cent. of their weight

per half hour, after the first fifteen minutes during which the rattler is revolved. Other tests, such as the endurance of brick when twisted and pressure is exerted upon them in various directions, will be made in the future.

MASSACHUSETTS ROAD MATERIAL.

A section of land has been purchased by E. T. Sawyer and G. S. Colton, of East Hampton, Mass., with a view to the town assuming ownership of it whenever it is desirable to begin a system of road improvement. It consists of a practically unlimited bed of trap rock and quantities of sandstone. The soil is the well known red earth that results from the disintegration of this sandstone and makes such hard, durable roads.

VITRIFIED BRICK IN THE EAST.

Regarding the use of vitrified brick for paving, Frank B. McAvoy, of Philadelphia, says: "It is acknowledged by paving experts that vitrified brick is superior to any other sectional block pavement known, and the only reason why it is not in more general use in eastern cities is because of the cost of transportation, which brings it into competition with asphaltum blocks and sheet pavement which are made at or near where the work is being done."

MISSOURI ROAD IMPROVEMENT CONVENTION.

A road improvement convention will meet at Columbia, Mo., October 17th, 18th and 19th. Exhibits will be made by road machinery companies, of graders, excavators, rock crushers, steam and horse-power rollers, etc. General Roy Stone, of Washington, D. C. will be present, and the Missouri Roads Improvement Association, the State Board of Agriculture and the State University will render what aid they can to the success of the convention.

BRICK PAVEMENTS AT CINCINNATI.

In response to an inquiry made by Engineer Ellis, of Toronto, Can., regarding brick pavements, H. J. Stanley, chief engineer of the Board of Administration at Cincinnati, wrote:

"We are still using brick for street paving. Our experience is that some brick are better than others. Most of our brick streets are good. They are laid in the best manner, six inches of cement concrete foundations and pitch joints. No giving way of foundation. We have some streets that are showing wear under heavy traffic, though nothing that can be classified as failures."

OPPOSED TO THE CIRCLE STREET.

William A. Sweet, Syracuse, N. Y., is opposed to the proposed plan of utilizing the park at the intersection of East Onondaga, Jefferson and Montgomery streets. Onondaga street is to be paved with asphalt, and the plan of the property-owners is to have a circle constructed in this intersection, and the pavement laid in conformity with this idea. By the construction of the circle, two parks, which now lie on either side of Onondaga street, would be abandoned. The triangle to the south would be turned into a roadway on the south side of the circle, and north of it in Jefferson street, and east of it in Montgomery street, would run the double street car tracks in the Jefferson street side and a little more on the Montgomery street side, would be allowed the usual

driving space. Mr. Sweet, when showed a diagram of the proposed circle, suggested that instead of a circle being placed in this square, the space should be left open for driving, and that the double tracks be sent straight across the square from the corner of Montgomery and Jefferson streets.

MACADAM IN KANSAS CITY PARKS.

New specifications for macadam paving have been prepared by City Engineer Filley and Landscape Engineer Kessler, of the board of park and boulevard commissioners, at Kansas City, Mo. Hereafter all macadam pavements laid in the streets of the city will be in accordance with the established rule of the park board. The specifications provide that on the subgrade prepared there shall be spread a layer of limestone crushed rock, each stone being from 2 to 3½ inches in its greatest dimension: upon this layer is to be spread a second layer of the same material, each stone being from 1¼ to 2½ inches. The top of the second layer shall be 3½ inches below the grade of the street. Limestone screenings shall be spread upon the layers to fill up all interstices.

The wearing surface to be spread upon the foundation is to be of broken granite, with the interstices filled with bank gravel, the top being ½ inch below the grade of the street. The layer shall be flooded and rolled. The granite to be used shall be the Wisconsin product known as the Berlin granite, or some other granite of a uniform uncrystallized structure proved to be equal to the requirements of macadam pavement.

The crosswalks are to be of sandstone, 18 inches wide, 3 feet long and 7 inches thick, and between the street-car tracks and the crosswalks shall be placed sandstone blocks to connect the two ends of the crosswalks extending from the gutter to the outside track.

UNJUST ASPERSIONS OF PUBLIC OFFICIALS.

A common evil of the times is the readiness and recklessness with which public officials are accused of being actuated by improper motives in the discharge of their duties. Faithful and conscientious men who do that which they know to be best, regardless of ignorant or mistaken opposition, are most likely to suffer from this sort of aspersion. Such charges have recently been made at Cleveland, Ohio, against Director of Public Works Farley. In an interwiew regarding the matter, Mr. Farley said:

"We are having considerable trouble with some of the property-owners on streets which are to be paved with brick. It is much harder to get first-class brick for a pavement than it is to get stone. It is not so much in the make, either. One kiln of brick may be first-class, while another may be spoiled in the burning and be unfit for use. Some people have said that there are employes in the engineer's office who are financially interested in a certain make of brick, and that they will not recommend any other for street paving. The representative of this same brick company has come to me and said that the engineering department was prejudiced against his brick, and would not recommend it for the street. Thus you see we are between two fires, and the charges are unfounded in both cases. The men who have been charged with being interested in a brickyard have been in the employ of the city through many administrations. They are

among the most honest and faithful men in the employ of the city. They are not interested in any brick concern, and their sole aim is to work for the interests of the taxpayers and the city."

IMPORTANT CHANGES IN LOUISVILLE'S SEWERAGE SYSTEM.

Charles V. Mehler, city engineer of Louisville, Ky., has made plans for a sewer which will drain an area of 775 acres. The sewer begins 10½ feet in diameter, at a point 180 feet west of Twenty-ninth street, in Broadway, and occupies the place of a 9½ foot sewer for the distance of 180 feet, and continues due east as a 10½ foot sewer, a distance of 579 feet, to a curve of 100 feet radius; thence south out Twenty-eighth street to the crossing of the old 9½ foot sewer. The enlargement and absorption of the main artery of the city sewer system takes place at this point. The enlargement of the 9½ foot sewer was made necessary by a 5½ foot sewer through Parkland having to empty into it. It was then determined to abandon the use of the 9½ foot sewer, for running a 5½ foot sewer into one already running at its full capacity would cause overloading and backing up of sewerage in all of the territory south of Broadway and west of Second street. This was accomplished by a system of "cups" placed at different elevations in the sewer wall, which, when filled, would show the height of the sewage flowing, and at the point of junction of the two sewers. The 5½ foot sewer was finished into the point where the absorption of the old sewer took place. The old sewer was dammed up to a height sufficient to keep back the sewage until the 10½ foot sewer could be finished, and the overflow was carried over the top of the workmen's heads by means of a wooden flume.

LEGAL DECISIONS.

[Reported specially for Paving and Municipal Engineering.]

Liability for Pollution of Streams by Sewers.—Where a city constructs sewers so that they empty into a stream and render unfit for use all the waters on a farm, by reason of part of the stream going underground through seams and fissures in the limestone bed of the stream, damages may be recovered by the owner of the farm. Good *v.* City of Altoona (Supreme Court of Penn.), 29 At. Rep. 741.

Liability of Municipal Corporations for Defective Streets.—A city whose charter confers on its officers the power of commissioners of highways in towns, with authority to make, regulate, and repair the highways and streets within its corporate limits, is charged with the duty of seeing that the streets are kept free from obstructions, and in good condition and repair; and it is not exonerated from liability by the fact that the obstruction is placed in the street by a railroad company. Byrne *v.* City of Syracuse (Supreme Court, General Term, Fourth Dep.), 29 At. Rep. 912.

Limitation of Action to Set Aside Street Assessment.—Buffalo City Charter, providing that any action or proceeding to test the validity of an assessment shall be commenced within one year after the assessment roll is delivered, does not apply to an action to set aside an assessment as a cloud on title because of illegal, arbitrary and wrongful acts of the officers levying the assessment. Brennan *v.* City of Buffalo (Superior Court of Buffalo, Equity Term), 29 N. Y. Supp. Rep. 750.

Who are Fellow-Servants.—A laborer employed in building a bridge, and an engineer, operating the hoisting machinery for its construction, are fellow-servants where both belong to the same working force, under the orders of the same foreman; and the master is not liable for an injury to the laborer from the negligence of the engineer. The master's order to lower a beam during the process of construction of a bridge does not render him liable for the act of his servant (charged with the execution of the order) in lowering the beam so carelessly as to inflict injury on a fellow-servant. Bryan *v.* McCully (Supreme Court of Missouri, Div. No. 1.), 27 S. W. Rep. 532.

Right to Recover Payment for Void Assessment.—Where a sewer assessment, valid on its face, is void because the contract was let without advertisement for proposals, an owner of assessed property may recover payment made by him in ignorance of the invalidity. Mutual Life Ins. Co. of New York *v.* Mayor, etc., of New York City (Supreme Court, First Term, General Department), 29 N. Y. Supp. 980.

Negligence in Sewer Building.—Plaintiff was injured by the caving in of a sewer in which he was working, under a foreman whose principal duty was superintendence. The trench was unbraced, except by blocks of earth left for that purpose, 25 feet apart, and there was no extraneous cause for the caving in. The negligence of defendant's foreman was for the jury to determine as a question of fact, rather than for the court, as a matter of law.

In such case, the question of plaintiff's negligence, though he was experienced in digging such trenches, was also for the jury. Henessy *v.* City of Boston (Supreme Judicial Court of Mass.), 37 N. E. Rep. 668.

PERSONAL.

Mr. George W. Wynn, of Cedar Rapids, Iowa, has made plans for water-works at Springville and Sigourney, Iowa.

A. W. Gates, C. E., of Aurora, Ill., has been appointed superintendent of sewers and pavements for a year, at Muscatine, Iowa.

Prof. Olin H. Landreth, of Nashville, Tenn., will begin the ensuing college year in the chair of civil engineering at Union College, Schenectady, N. Y.

Colonel George E. Waring, Jr., of Newport, R. I., has been engaged by the board of public works, of Jacksonville, Florida, to prepare plans and specifications for the sewerage of that city.

Messrs. H. A. Collar, L. C. Stow, and A. E. Worden, of Grand Rapids, Mich., made a recent visit to Richmond, Indianapolis, Cincinnati, Columbus, Dayton, Zanesville, Cleveland and Detroit, for the purpose of investigating the paving of those different cities.

Mr. John Klein, of Mankato, Minn., made a recent visit to Winona for the purpose of examining that city's system of street paving. He approved the brick pavements he saw and pronounced them superior to the brick paving in Eastern cities. He thinks that brick can be manufactured in Mankato, and, if so, a steady market would be had in St. Paul, Minneapolis, and other cities of the State. Mr. Klein recommends that Front street be paved with brick on a stone foundation.

Mr. Walter Lodian, who for several months has been traveling along the Pacific coast, gathering information on engineering subjects for PAVING AND MUNICIPAL ENGINEERING and other journals, has gone to Asia for a two years' trip. Mr. Lodian will visit various islands of the South Pacific, Australasia, India, China, and Japan; he will then go to Siberia and make the overland journey to Paris, a desert route of from 9,000 to 10,000 miles.

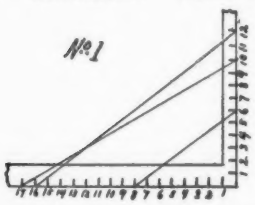
LETTERS FOR THE PUBLIC.

A SEWER PROBLEM.

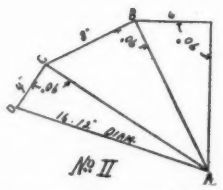
To the Editor of Paving and Municipal Engineering:

Given two pipes 8 inches and 6 inches in diameter, to find the diameter of a single pipe equal in capacity to the two.

Solution: Find 8 inches on one blade of a carpenter's square and 6 inches on the other. Now measure across with rule, on hypothenuse from 8 inches to 6 inches and you find 10 inches as the required diameter, equal in area to the two pipes. If one pipe is 16 inches and the other is 12 inches diameter, measure across from 16 inches to 12 inches and you have 20 inches as the required diameter.



This rule can be reversed. Thus 20 inches being the greater, to find two other diameters equal in capacity to the one, place end of rule at 16 inches and find where 20 inches, measured across, will cut the other blade off square, *i. e.*, at 12 inches, and the thing is done. Or, place one end of rule at 10 inches, and find where 20 inches, measured across, will cut the other blade, *i. e.*, at 17.32 inches equal the other diameter.



Again, we have 12 inches, 6 inches, 8 inches and 4 inches as the diameters of four pipes. Graphically we solve the problem by constructing the following figure: AD scaled is equal to all the diameters. AC scaled equals 12 inches, 6 inches and 8 inches, and AB equal 12 inches and 6 inches. Or,

$$AD=\sqrt{12^2+6^2+8^2+4^2}=16.1245 \text{ inches.}$$

This is founded on the theorem that the area of circles are to each other as the squares of their diameters. *F. R. Lockling, C. E.*

Hannibal, Mo., Sept. 3, 1894.

THE WATER SUPPLY OF A NEBRASKA CITY.

To the Editor of Paving and Municipal Engineering:

The question of a supply of good potable water is the most important one with which we have to deal today. In the year 1886 we expended $80,000 in building a water-works plant; and since that time we have expended about $25,000 more in extensions, and about $30,000 in trying to obtain an ample supply of good pure water. But up to date we have nothing to show for the last $30,000, and we are still pumping our water direct from the river.

When we built our original plant J. D. Cook, of Toledo, Ohio, was our consulting engineer. It was his judgment that we would always be compelled to depend on the river for our supply of water; and, up to date, it must be admitted that Mr. Cook was right. The river here will always furnish plenty of water, such as it is, and during about eight months of the year it is very good water indeed, so far as looks and agreeableness to taste and suitability for laundry purposes are concerned; though, be it said to the discredit of our fair city, we do not know what chemical analysis would show. So far as we know, however, there have never been any bad results from using this water for domestic purposes.

The river has its source south of the Platte, about seventy-five miles north of Beatrice. Its banks are, for the most part, low. It flows through a thickly populated region of country, and gets the washings of a great many swine and cattle feed yards. During times when there are freshets it holds a great deal of matter in suspension, as well as in solution.

Our city has a population of 15,000 people, and at this time of the year we use about 2,000,000 gallons of water per twenty-four hours.

As I have said already, several attempts have been made to get a supply outside of the river, and $30,000 have been expended in these investigations, with no good results to show for it. But we have obtained some valuable information, though it has cost too much. What is known here as the "point system" has been tried also, but with no good result. At a place where there seemed to be plenty of sheet water, where the bed-rock was thirty feet below the surface of the ground, and the water was twelve feet deep in sand, eighty three-inch points were put down, and only about 100,000 gallons per twenty-four hours could be pumped from them.

About 22 years ago a well was bored here to a depth of 1,250 feet; at a depth of 45 feet bed-rock was reached, and at a depth of about 300 feet salt water was found. No good record of the different strata was kept; but so far as I have been able to learn the rock was mostly of bluish limestone. At times the well now flows a small quantity of salt water.

All about here in this vicinity the bed-rock is all the way from 30 to 150 feet below the surface of the rolling prairie. And so far as I know there is everywhere sheet water on top of the bed-rock; in some places it is 2 feet deep, while in others, it is 20 feet deep. But on top of the bed-rock, there are, in places, streaks and layers and pockets of clay, together with a good deal of quicksand. At one of the places where it was thought that the indications for sheet water were best, a 16 foot well was put down to bed-rock, and so constructed that the water could flow in freely. This well, pumped continuously for ten days, was found to furnish about 125,000 gallons per 24 hours. And it was also found that the pumping lowered the water in other wells in that vicinity that were not more than 1,000 feet away.

At this particular place, where this well was dug, there was about 15 feet of black and clay soil, and 14 feet of fine sand; and the water was found to be about 11 feet deep on top of the bed-rock. At another point a smaller well was dug down about 25 feet to bed-rock, and about 12 feet of water found in

fine sand, mixed with a small quantity of clay. This well was about 1,200 feet distant from the river; and I found the surface of the water in the well was 9 feet higher than the surface of the water in the river.

Just what we will do in the future about pure water I can not say. It has always been my opinion that the best thing to do is to build settling basins and filtering beds, and purify the river water.

Willis Ball, City Engineer.

Beatrice, Neb., Sept. 22.

MACHINERY AND TRADE.

RECENT INVENTIONS.

[Reported specially for PAVING AND MUNICIPAL ENGINEERING by Chandlee & Chandlee, Washington, D. C.]

Pavement Block. Louis Weinman, Munich, Germany. 1. A paving composition consisting of eighty-five parts of wood pulp, five parts of clay, five parts of cement, and five parts of asphaltum. 2. A paving block consisting of compressed wood pulp provided with a mineral mixture of cement, asphaltum, and clay in the proportions of about five parts each to eighty-five parts of the pulp.

Excavator. John P. Griffin, St. Louis, Mo. An excavating apparatus comprising a float or platform, a motor thereon, parallel drums geared to the motor, clutch mechanism for throwing the drums into and out of gear with the motor, a framework on the float or platform in front of the drums and provided with guide pulleys, a short framework provided with vertical guide pulleys and horizontally turning guide pulleys in rear thereof, an operating rope or cable secured to drum and extending under pulley, over pulley, around pulleys, thence around pulley and outwardly around pulley and thence to drum, and the shovels connected with said rope or cable.

Method of and Apparatus for Burning Garbage or other Refuse Material. Jas. C. Anderson, Highland Park, Ill. A method of burning garbage and other refuse material, which consists in loading the same upon movable fire-proofed cars, passing the same through a continuous kiln toward a fire zone located at one point thereof supplied with oil and air under pressure and ignited, subjecting the material in its progress toward the fire zone to the action of radiated heat, and extracting the moisture and gases from the mass, conveying the moisture and gases so extracted to the fire zone, and at that point supplying them with oxygen and causing them to combine with the injected fuel and to attack and incinerate the advanced load to be operated upon.

Street-Sweeper. Frederick W. Dessau, Amsterdam, N. Y. 1. In a street sweeper, the combination with a wagon having a downwardly inclined portion at the rear end of its body and provided with a horizontal extension projecting from the body, of a frame hinged to the said inclined portion within the horizontal extension, rollers mounted in the said frame, sprocket wheels mounted upon supports carried by the wagon body, an endless chain of brushes passing over the sprocket wheels and the rollers, gearing for

operating the endless chain of brushes as the wagon moves forward, means for raising the frame, and a locking device for locking the frame to the said horizontal extension, substantially as described. 2. In a street sweeper, the combination with a wagon having a downwardly inclined portion at the rear end of its body, and provided with a horizontal extension projecting from the body, of a wheeled frame hinged to the said inclined portion, within the horizontal extension, rollers mounted in the frame, spocket wheels mounted in supports carried by the wagon body, endless chains passing over the sprocket wheels and the rollers of the hinged frame, brush heads secured to and connecting the said chains, gearing for operating the endless chain of brushes as the wagon moves forward, a catch for locking the frame to the horizontal extension, and means for releasing the catch and raising the frame. 3. In a street sweeper, the combination with a wagon having a downwardly inclined portion at the rear end of its body, and provided with a horizontal extension projecting from the body and having downwardly extending outer ends, of a wheeled frame hinged to the inclined portion within the horizontal extension, rollers mounted in the frame, sprocket wheels mounted in supports carried by the wagon body, endless chain of brushes passing over the sprocket wheels and the rollers of the hinged frame, gearing for operating the endless chain of brushes as the wagon moves forward, spring latches secured to the hinged frame and adapted to engage the downwardly extending ends of the horizontal extensions, and chains secured to the latches and extending to the forward part of the wagon, whereby the latches can be disengaged and the frame raised.

Paving Block. Joseph H. Amies, Philadelphia, Pa., assignor to the Amies Paving Company, Camden, N. J. 1. A paving block having a dense central part of compressed vegetable fiber only and an exterior part composed of such fiber saturated with a plastic material impervious to moisture. 2. A paving block of peat or equivalent vegetable fiber, having a dense part composed of such material only and an exterior incasing part composed of such material saturated with any resinous composition impervious to moisture.

Street-Sweeper. Henry Mueller, Jr., St. Louis, Mo. 1. In a street-sweeping machine, an angular broom shaft having suitable supports for the outer ends thereof, an open receptacle located adjacent to the same, suitable running gear for said broom-shaft, brooms on said shaft, a bracket for supporting the joint end of the shaft, a support for said bracket, lateral extensions on the free end of the bracket, rollers mounted on said extensions, a suitable guide for said rollers, and a weighted arm secured to the guided portion of the bracket to balance the weight supported by the bracket. 2. In a street-sweeping machine, a main broom or brush-shaft and a supplemental broom-shaft, a knuckle joint connecting the said shafts, suitable bearings for the outer ends of the said shafts, suitable guides for said bearings, a bracket for supporting the end of the main shaft adjacent to the knuckle, a suitable guide for said bracket, a balancing arm for said bracket, and suitable chains secured respectively to the bearings of the shafts and to the bracket for elevating the broom-shafts.

Road Leveler. Nathaniel S. Monroe, Arcola, Ill. 1. A road scraper or leveler, with two independent

scraper bars, and so arranged that one of said scraper bars projects beyond and overlaps the track formed by its opposite scraper bar. 2. In a road scraper, or leveler, the combination with adjustable scraper bars and of the mechanism (or its equivalent), for spreading, or for contracting, the angle of the same, which mechanism consists of chain, winding-drum, hand-wheel and pawl and ratchet-wheel. 3. In a road leveling machine provided with pivoted bars, adapted to slide, the hangers and for rigidly supporting the scraper bars. 4. In a road leveler, the combination with scraper bars, one of which is longer than its fellow, and projecting beyond it rearward, the reach-bars secured to a double-tree, and pivotally connected therewith. 5. In combination with a road leveler, having one scraper bar projecting beyond the rearmost end of its opposite scraper bar, a single caster-wheel, mounted on a beam, and pivotally connected through the medium of the lever for the purpose specified.

Excavating Machine. Caleb H. Parker, New Orleans. 1. In an excavating machine, the combination of a frame mounted on wheels or rollers, a box-shaped excavator supported at the forward end of said frame and having its open front end provided with cutters, a derrick and a motor mounted on the machine frame, a series of dredge buckets carried by endless chains mounted on the derrick, said buckets adapted to work in the box-shaped excavator, gearing for driving said bucket-carrying chains from the motor, a pair of drums mounted horizontally one above the other on the machine frame or platform, gearing for actuating said drums from the motor and in opposite directions to each other, and traction cables engaged with said drums on opposite sides of the machine and having their ends secured to supports in advance and in rear of the machine.

Process of Forminy Cement Walks. William J. Haddock, Iowa City, Iowa. The method of forming walks, ways, blocks, etc., consisting of forming a base of natural hydraulic cement and sand, compressing the same, coating the surface thereof with water, adding a layer of cement to the water, applying a top of artificial cement and sand and compressing the same.

Man-hole Cover. Thomas P. Greger, Philadelphia. The combination in a highway or footway pavement of a dished man-hole cover filled with paving material and having a smooth and uniformly tapered peripheral surface, and a rim or seat located at the entrance of the man-hole and provided with an upwardly projecting internally and externally tapered bearing which by reason of its form not only retains the cover, but also snugly hugs the adjacent pavement and its foundation whereby the rim or seat is firmly and securely held to place, and whereby the adjacent edge portion of the pavement is protected, substantially as described.

Street-Sweeper. John H. Reynolds, Chicago, Ill. 1. In a sweeping machine the combination of a suitable main frame, a supplemental frame pivoted therein and a brush journaled in said supplemental frame and arranged longitudinally with the direction in which the sweeper moves and means for revolving said brush. 2. In a sweeping machine the combination of a suitable main frame, a pivoted supplemental frame, a brush journaled in said supplemental frame, longitudinally with the direction of movement of the sweeper, gearing

for rotating said brush, a guide plate arranged in front of said brush over which the sweepings from said brush may be directed.

Street-Sweeper. William A. Green, Trenton, N. J. 1. In a street-sweeping machine, the combination of a rotary brush, located transversely to the movement of the vehicle, a dirt receiver, consisting of a transversely located horizontal tray adjacent to the brush, a dust guard surrounding the tray, and open on the side next to the brush, a box-shaped elongated chute leading outward and upward in an inclined position from one end of the dirt tray, said end being pivotally mounted, and the upper end of the chute having a discharge mouth, a supplementary scraper pivotally supported in said mouth, a dirt conveyor, consisting of chains and scraper blades, secured thereto by means of which conveyer the dirt is carried upward through the chute and discharged at its mouth, and the chains shaft having pulleys on which the chains wind, all arranged for the purpose of adjusting the chute.

Means for Grading Streets or Road Beds. John J. McMahon, Toledo, Ohio. 1. In grading streets or road beds, a trestle, a track-way, inclined from the center upwardly toward each end, trolleys upon the track-way, having an automatic movement to the center, and means for moving the same outwardly, pulleys carried by the trolleys, draft ropes passed over the pulleys, dumping scrapers connected to the draft rope at one end, the opposite ends connected with the source of power. 2. In grading streets, a trestle comprising sills each provided with removable rollers, vertical standards upon the sills, a cross-beam connecting the standard tracks inclined from the standards to the center of the trestle, dumping scrapers, comprising the bowl and bail, and an automatic catch to hold the bowl from tilting, a sheave movably sustained upon the inclined tracks, a draft rope, or cable, connected with the scraper, passed over the sheave and connected with a source of power, and a means for loosening the catch to allow the scraper to dump the load when elevated.. 3. In grading streets or road beds a trestle, inclined tracks, trolleys thereon carrying pulleys, scrapers, draft ropes connecting the scrapers and passing over the pulleys to the source of power, pulleys upon each side of the trestle, and ropes connecting each trolley passing over the pulleys in convenient reach at one side of the trestle.

Manufacture of Asphalt, etc., from Petroleum. Francis X. Byerly, Cleveland, Ohio. 1. The process of making asphaltic products, by prolonged exposure of petroleum tar to a pitch-forming, non-coking temperature in a still, with agitation of said tar, and exposure of the same to air. 2. New asphaltic petroleum products, soluble in benzine, varying in hardness at atmospheric temperatures from a rubber-like consistency to a mass of a hardness and conchoidal fracture like the natural asphaltums, the less hard having also a conchoidal fracture at lower temperatures, melting at from about 200° Fahrenheit to about 400° Fahrenheit according to hardness, and in general having characteristics belonging to asphaltic residual products from a prolonged exposure to petroleum tar to a pitch-forming non-coking temperature in a still with agitation of said tar and exposure of the same to air in contradistinction to previously known natural or artificial products of a more or less asphaltic character.

Steam Road Roller. Edward T. Wright, Springfield, O., assignor to the O. S. Kelly Company, same place. 1. In a road roller, the combination with the main driving wheels, and a steering wheel or wheels, said driving wheels being provided with extended portions adapted to overlap the tread of said steering wheel or wheels, said extended portions being beveled. 2. In a road roller, front and rear wheels, as described, one set of said wheels being adapted to overlap the tread of the other set, with the overlapping portions of one set beveled. 3. In a road roller, main supporting and driving wheels, and a steering wheel or wheels, the tread of which occupies a space between said main wheels, said main wheels having a substantially uniform diameter as to those portions of which project beyond the tread of the steering wheel or wheels, and a reduced and beveled portion for overlapping the tread of said steering wheel or wheels.

SOME IMPROVEMENTS IN BRICK KILNS.

At the annual meeting of the North of England Institute of Mining and Mechanical Engineers, held in Newcastle-on-Tyne, August 4, R. W. Moore read a paper on "Improvements in Brick Kilns," some of which he said consisted in conveying what was hitherto waste gas into a combustion chamber, shaped like a bee hive, built at the back of the kiln, by means of three flues. Two plugs or valves admit a small proportion of air into the top and bottom of the combustion chamber, thereby raising the ignited gaseous mixture to a white heat, and bringing the brickwork intervening between the combustion chamber and the kiln into an incandescent state. The intense heat at the rear of the kiln ensures that the charge is burnt as well at the back as at the front, and experience has proven that the charge is evenly burnt throughout. From the bottom of the combustion chamber the ignited gas is conducted by a flue passing immediately beneath the kiln, thus heating it still further along its entire length, into a main flue that traverses the full length of the range of kilns, whence it can be gradually admitted by regulating dampers into one or more of the adjoining kilns by branch flues that enter the front of the kilns. By an arrangement of dampers, the waste heat from the combustion chamber can also be conveyed to other kilns.

THE MOORE HOISTER AND CONVEYOR.

The Moore Manufacturing Co. has issued a handsome new catalogue describing their new works at Buffalo, and giving the history of the development of the Moore Hoister and Conveyor, with testimonials to its extraordinary efficiency, together with attractive illustrations showing its operation at different points in the country. The advantageous points of the machinery are specifically described. The catalogue contains much information of value to sewer contractors, and it is well worth their while to acquaint themselves with the Moore Hoister and Conveyor, which is undoubtedly a great economizer of time and labor. Several new patents on the invention have recently been granted, and others are now pending. [Moore Manufacturing Co., Buffalo, N. Y.]

NOTES.

The Kansas City Paving Company, Kansas City, Mo., has filed articles of incorporation, and will contract for street paving and grading.

On August 23 Louis Hammersmith was named receiver for the Hoosier Vitrified and Ornamental Brick Company, at New Albany, Ind.

The O. S. Kelly Co., of Springfield, O., made a recent sale of one twelve and a half ton steam road roller to the city council of Kenton, Ohio.

A sale of the buildings and machinery of the insolvent Anderson Pressed Brick Company, Chicago, will be made to satisfy the bondholders.

A machine for use on poor brick pavements will be introduced at Cincinnati by the Mack Manufacturing Company of Pittsburg. The machine shaves off one-half inch of the surface of the streets, rendering them smooth, after which one inch of asphalt is put on.

Parties from Albany, N. Y., have been prospecting the granite quarries at Conklinville, N. Y., with a view to the manufacture of street-paving and curbing blocks.

The Bermudez Paving Company has been incorporated at Syracuse, N. Y., by Horace White, John N. H. Drake, Robert E. Drake, Charles Hughes and Leonard H. A. Saxer.

The Woodland Clay Red Pressed Brick Company, Janesville, Wis., has been incorporated by John W. Carpenter, George L. Chittenden and O'Lansing De Forest. Capital stock, $100,000.

The Stonington Brick and Pottery Company, Stonington, Miss., recently sent to Chicago for test a sample of a blue-shale brick for street pavements, which is said to surpass any other brick for durability and cheapness.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

La Salle street, Chicago, Ill., is being paved with asphalt.

The asphaltic pavement on Grand avenue, Milwaukee, Wis., is completed.

The estimated cost of paving Main St., with brick, at Pittston, Pa., is $87,000.

Frank C. Bushnell, New Haven, Conn., has petitioned for a new system of street pavements.

The brick pavements in High, Walnut and East Short streets, Lexington, Ky., are completed and give much satisfaction. Spinks & Sons, of Newport, had the contract.

F. F. Rogers, Port Huron, Mich., writes that cedar block pavements have been completed in that city at the following cost: Howard street, $1,320; Stone street, $9,000.

The vitrified brick pavement on South Michigan street, South Bend, Ind., is completed at a total cost of $34,586.51. The satisfaction it gives almost assures it as the future paving material in that city.

A delegation of city officers from Piqua, O., recently visited Toledo, to inspect brick pavements, and Detroit to inspect asphalt pavements. A contract had been awarded at Piqua, to Sullivan & Gertz, of Columbus, for about three miles of streets, but the material has not been selected.

Under the supervision of the board of public works, at New Haven, Conn., the asphalt block pavement on Temple street, leading to the "green," a pleasure ground, has been replaced with granite blocks, with satisfactory results, and eventually all of the blocks will be replaced in a like manner. The old pavement was laid seven years ago, and was pronounced an admirable piece of work.

McGugin & McRae, of Davenport, Ia., who have the contract for paving Second street, and Iowa avenue, at Muscatine, have commenced operations. The street is graded and rolled with a seven-and-one-half-ton roller; six inches of macadam is laid over the surface of the street, then covered with one to two inches of dry river sand and again thoroughly rolled, when four more inches of sand is put on; on this is laid a course of brick set edgewise, except at street intersections, where the brick are set in diamond shape. After the brick are laid they are rolled with a two-and-one-half-ton roller.

Preston, Conn., has almost ninety miles of roads, nearly all of which are being permanently improved this year, under the supervision of the selectmen. The first intention of the citizens was to let the streets out by contract at a price not to exceed $1,600 a year. After advertising for and receiving bids it was apparent that the work could not be done by contract within the amount voted by the citizens, and accordingly the selectmen undertook the work themselves. Lewis E. Potter took an eighth section, and Charles B. Chapman and George V. Shedd took the remainder. Under the supervision of Mr. Chapman, the work was begun last April, and is still being carried on. The roads are in finer condition than they have ever been before.

CONTEMPLATED WORK.

Sundry alleys at Joliet, Ill., will be paved with brick.

West Linden street, Washington, Pa., will be paved this fall.

Ionia, Mich., still contemplates paving Second and Depot streets.

Paterson street, Jersey City, N. J., will be paved with Belgian blocks.

East Ninth street, Canton, O., will be paved and otherwise improved.

The B. of A., at Cincinnati, O., has resolved to pave Albion place with brick.

An effort is being made to have corporations repave West Side streets at Chicago, Ill.

The approaches to the post-office, at Wilmington, Del., will be paved with brick.

A resolution has been adopted at Cleveland, Ohio, for paving Scranton avenue with brick.

Water street, at Port Huron, Mich., is to be paved with brick on a 5-inch concrete foundation.

The city council at Dubuque, Ia., contemplates paving Clay street and Couler avenue next spring.

The council at Warren, Ohio, has authorized the paving of Market street and Park avenue.

The construction of a graveled boulevard, three miles in length, is contemplated at Green Bay, Wis.

The cobblestone pavement on Water street, Newburgh, N. Y., is to be replaced with asphalt block.

The property-owners on Capitol avenue, Atlanta, Ga., contemplate paving that street with asphalt.

A special appropriation of $30,000 has been made at New Bedford, Mass., for street improvements.

The city council at Zanesville, O., has passed an ordinance for paving East Main street with vitrified brick.

Academy street, Newark, N. J., is to be repaved with oblong granite blocks on a 6-inch concrete foundation.

The paving of Charlotte street with granite block has been recommended, at a cost of $18,445, at Norfolk, Va.

A petition has been made to Mayor Latrobe, Baltimore, Md., asking that the repaving of McCulloh street be completed.

Through the efforts of the Omaha View Improvement Club, Omaha, Neb., Lake, Erskine and other streets will be improved.

An ordinance has been passed at Leavenworth, Kan., providing for repaving Delaware street with vitrified brick, at a cost of about $8,000.

The macadamizing of parts of First, Second, Sixth, Lincoln and Stevens avenues, and Second and Third streets, is contemplated at Mt. Vernon, N. Y.

A petition has been approved by the board of public works at Kansas City, Mo., for paving Fourteenth street, from Broadway to Virginia, with asphalt, at a cost of nearly $55,000.

The property-owners on Market street between Twelfth and Thirteenth, Louisville, Ky., have petitioned the board of public works to pave that block of the street with granite.

A resolution has been passed at Indianapolis, Ind., for paving West street with brick on a concrete foundation and curbing with stone. A petition has also been made for an asphaltic pavement on Park avenue.

The trustees of Johnstown, N. Y., have passed a resolution for the extension of Mill street, which is newly macadamized. It is probable that the new extension will be macadamized in the near future, thus making a fine boulevard between Johnstown and Gloversville.

The United States Government has been so impressed with the chert paving on Tenth street and Georgia avenue, at Chattanooga, Tenn., that it will advertise for bids for paving the roadway from the East End avenue to the National Cemetery with the same material.

The board of public works, at Ft. Wayne, Ind., has recommended the paving of Superior and Wells streets. Harrison street will also be paved with brick.

It is proposed, at St. Paul, Minn., to pave twenty-four feet in the middle of Summit avenue with brick on a concrete foundation, and the remaining twelve feet on both sides with granite on a sand foundation. For a distance of three blocks South Robert street will be paved with eight inch cedar blocks on a sand foundation.

CONTRACTS TO BE LET.

Bids will be received until October 11, at Cincinnati, O., for paving the roadway of Eden Park bridge with asphalt.

Sealed proposals will be received at Omaha, Neb., until October 5, for curbing with red Colorado sandstone Jackson street, from Thirty-sixth to Thirty-eighth streets.

Bids are invited at South Bend, Ind., until October 8, for paving the sidewalks in Priscilla street with brick, and in St. Peter and West Birdsell streets with cement.

Sealed proposals will be received until October 8, at Wabash, Ind., for the completion of the improvements of the sidewalks on both sides of Stitt street, by grading and paving.

CONTRACTS AWARDED.

Scott street, Warsaw, Ill., is being paved by Burns & Stevens.

Geo. W. Good was awarded the contract at Greensburg, Pa., for paving Talbott avenue.

The Barber Asphalt Company was awarded the contract for paving Pine street with asphalt, at Scranton, Pa.

The contract for paving Denison avenue with fire brick, at Cleveland, O., was awarded to Christ Lardo, for $14,779.30.

J. B. Smith secured the contract for paving Grand avenue, Kansas City, Mo., with vitrified brick, for $1.07 per square yard.

G. W. Gosnell was awarded the contract at Louisville, Ky., for paving Third street with Mack repressed brick, for $23,277.86.

The Warren-Scharf Asphalt Paving Company secured the contract for paving Jefferson and Fifth streets, at Dayton, O.

The contracts for paving Sibley and Fourth streets with asphalt, at St. Paul, Minn., were awarded to Hennessey Bros. & Cox.

The contract for paving Nicollet avenue, Minneapolis, Minn., with brick, was awarded to the Minneapolis Brick Paving Co., which will furnish the best quality of Purington vitrified brick for $1.90 per square yard.

The Trinidad Asphalt Refining Company was awarded the contract for paving and curbing Flournoy and Lexington streets, at Chicago.

The contract for paving Nineteenth street with Colorado sandstone block, at Denver, Col., was awarded to Hugh Murphy, of Omaha, for $61,658.35.

The city council at Charles City, Iowa awarded the contract for paving five blocks of Main street, with brick, to Kenety & McCann, of Dubuque, for $25,000.

The contract for an asphaltic pavement in Hennepin avenue, Minneapolis, Minn., was awarded to the Warren-Scharf Company, at $2.83 per square yard.

The contract for paving Barclay street, at Chester, Pa., with Savage repressed vitrified brick was awarded to John Hanna, at $1.97½ per square yard.

Udo Hesse, Saginaw, Mich., writes that on September 4 the contract for paving Jefferson avenue with macadam was awarded to John C. Schultz, for $8,566.34.

The West Park board, Chicago, Ill., will enter into contract with Sackley & Peterson for improving Douglas boulevard, by constructing a macadam drive. The work will be prosecuted at once.

The city council at Quincy, Ill., awarded to the Galesburg Paving Brick Company, the contract for furnishing the city with 750,000 bricks at 60.3 cents per square yard, for paving eleven blocks of streets.

The contract for paving Plane street, at Newark, N. J., with oblong granite blocks on a concrete base, was awarded to the New Jersey Asphalt Company. The contract involves an expenditure of $50,000.

The contract for constructing cement sidewalks at Chicago, Ill., was awarded to Kimball & Cobb at 11¾c. per square yard, making the total cost $24,000. The department engineers had placed the estimate at $54,000.

Recent contracts were awarded at Rochester, N. Y., as follows: Carthage alley, Medina stone, Whitmore, Rauber & Vicinus, $990; Ontario street, cement walks, E. L. & H. T. Oliver, $1,048.70; cement walks on the Boulevard, E. L. & H. T. Oliver, $7,233.90.

Paving contracts have been awarded at Kansas City, Mo., as follows: Independence avenue, granite macadam, Kansas City Building and Construction Company, $24,946.32; Thirteenth street, brick, J. E. Farris, $21,427.20; part of the public square, asphalt, Barber Asphalt Company, $1,039.76; Grand avenue, brick, F. G. Trestrail, $1,886.15; Park avenue, granite macadam, James O'Connor, $8,991.21; Fourteenth street, brick, G. B. Barclay, $495.80.

Contracts have been awarded at Davenport, Ia., as follows: Fourteenth and Sixteenth streets and Grand avenue, from Fifteenth to High, Des Moines Brick Manufacturing Company; Ninth street, McGugin & McRae; Grand avenue, from Fourteenth to Fifteenth streets, and the intersection on Main street, Flick & Johnson.

The Western Paving and Supply Company was awarded the contract for asphalt paving at Woodruff Place, Indianapolis, as follows; For 16-foot roadway, with combined curb and gutter, $4.59 per lineal foot; two cents per square yard per year for maintenance for second five years and five cents per square yard for third five years.

Contracts have been awarded at Syracuse, N. Y., as follows: Paving N. Clinton street, with Trinidad asphalt, Warren-Scharf Asphalt Paving Co., $922; paving S. Clinton street, with Trinidad asphalt, Syracuse Improvement Co., $919.10; paving E. Jefferson street, with Trinidad asphalt, Syracuse Improvement Co., $2,515.25.

N. B. Abbott was awarded the contract for improving S. High street, at Columbus, O., as follows: Hallwood block, Nelsonville make, $1.62 per square yard; furnishing and setting 5-inch curb, 32 cents per lineal foot; circle curb, 60 cents per foot; stone edging, 1 cent per foot; catch basins, $20 each; 15-inch pipe, 60 cents per foot; furnishing and laying sub-drainage pipe, ⅛ cent per foot.

SEWERS.

Nearly two miles of the sewer system at Cortland, N. Y., is completed.

The Fourteenth street sewer is being reconstructed at San Francisco, Cal.

The new sewerage system at Athens, Ga., is completed, and pronounced satisfactory.

Contractors' prices for sewer construction have never been so low in Milwaukee as they are now.

J. B. Vernon, city engineer at Huntington, Ind., writes that the Flint creek and Market street sewers are progressing nicely.

F. R. Lockling, city engineer at Hannibal, Mo., writes that the total miles of sewers constructed in that city for the year ending June 4, 1894, is 5.05 miles.

CONTEMPLATED WORK.

A sewerage system is contemplated at Nyack, N. Y.

Important sewer legislation has begun at Woonsocket, R. I.

A sewer is to be constructed in Liberty street, at Painesville, O.

An extensive sewerage system is being agitated at Bridgeton, N. J.

The question of a sewerage system is being agitated at Ontario, Cal.

Spink street, Wooster, O., is to be improved by the construction of a sewer.

An improvement in the sewerage system of Carrollton, O., has been suggested.

The construction of a sewer in West Rayen street, Youngstown, O., is contemplated.

Golden Gate, Cal., voted to issue bonds in the sum of $40,000 for a sewerage system.

Sewers will be constructed in about twelve streets in the annexed district, New York City.

The plans for a new system of sewerage, at Athens, O., have been approved by the state board of health.

Charles P. Chase, Clinton, Ia., writes that plans for a sewer system for Mendota, Ill., are in the hands of engineers.

A pipe sewer is to be constructed in East avenue, and in the New Brunswick turnpike, at Perth Amboy, N. J.

The common council of Salem, Mass., has appropriated $3,000 for building sewers in March, Rice, Bridge and Waite streets and Pierce avenue.

The proposed Eighty-third street sewer is one of the largest ever projected by the city of Chicago. It will drain an area of nearly nine square miles.

A board has been appointed to meet at Fort Monroe, Va., to prepare a draft of the rules for the sewerage system provided for in the last appropriation bill.

Ordinances have been passed at Trenton, N. J., authorizing the construction of sewers in Tyler, W. Hanover and Broad streets and in Hanford place.

Ordinances have been filed at Cleveland, O., providing for the construction of sewers in Norton, Hancock and Rayner streets, and Lake, Hough, Giddings and Highland avenues.

The board of public works, at Ft. Wayne, Ind., deems it necessary to construct a 12-inch pipe sewer in the alley, between Caroline and Warsaw streets, and in the alley north of Pontiac street.

It is thought that during the winter legislation will be enacted preparatory to the construction of at least three of the needed sewers, which have been recommended at Williamsport, Pa.

A new sewer, beginning where the Fourteenth street sewer crosses North Capitol avenue, will be built at Indianapolis, Ind., at a conservative estimate of $100,000, and probably $125,000. It will be about 19,000 feet in length.

CONTRACTS TO BE LET.

Bids will be received until October 16, for constructing sewers in drainage district No. 6, Mattoon, Ill.

Bids will be received until October 5, at Omaha, Neb., for the construction of a sewer in district No. 203.

Bids will be received, at Des Moines, Ia., until October 9, for constructing a 36-inch two-ring brick culvert on North street.

Sealed proposals will be received until October 8, at Hammond, Ind., for building a two-ring brick sewer in Calumet avenue.

Sealed proposals are invited, at South Bend, Ind., until October 8, for constructing a 24-inch pipe sewer on North Main street.

Sealed proposals will be received at Jacksonville, Fla., until October 10, for supplying not less than 200,000 feet of sewer pipe and specials.

Bid are invited until October 6, at Cincinnati, O., for constructing a semi-circular arch culvert on the Bank Lick road, Springfield township.

CONTRACTS AWARDED.

Lauer & Hagaman secured the contract for a sewer, at Rochester, N. Y., for $1,862.12.

Robert P. Ahern was awarded the contract for sewer construction at Quincy, Ill., for $5,700.

The contract for the big lateral sewer in Union Hill, N. Y., was awarded to Henry & McGibney for $147,293.

Geo. F. Seibel and Luther Dean, Taunton, Mass., secured the contract for building sewers in that city for $5,093.

The contract for the Princess-street sewer, York, Pa., was awarded to Odenwalt & Huber, whose bid was $10,820 for a 4-foot brick sewer, complete.

H. Ward, Binghamton, N. Y., writes that E. A. Matthews was awarded the contract for a pipe sewer in Riverside drive, 1,080 feet in length, for $2,992.

Contracts for sewers were awarded to W. J. Dowling, Port Richmond, N. Y., as follows: Van Pelt avenue, 1,400 feet $3,140; Harrison avenue, Sharp avenue, and Elm street, $8,359.46.

The contract for the tunnel trunk sewer at Niagara Falls, N. Y., was awarded to Hingston & Woods, of Buffalo, for $42,997.86. Contract No. 42, section 1, was awarded to Clement & Co., for $20,395.30; contract No. 42, Clement & Co., $18,343.20; contract No. 43, section 3, Clement & Co., $23,389.50.

Contracts for sewer construction have been awarded at Chester, Pa., as follows: Fourteenth street, $1.37 per lineal foot, and Fifth street, $1.33, J. B. Helms; Pennell street, 98½ cents per lineal foot, W. E. Riley.

W. W. Cook & Co., Jamestown, N. Y., secured the contract for constructing the system of sewers at Plainfield, N. J. Their bid was $18,858.29, considerably lower than the city engineer's estimate, which was $25,696.31.

Udo Hesse, Saginaw, Mich., writes that September 18, Ernest Jochen was awarded the contract for constructing a six-foot circular brick sewer, with outlet in the Saginaw river, in Michigan and Genesee avenues, for $9,043.13.

J. B. Vernon, city engineer at Huntington, Ind., writes that the city council awarded sewer contracts as follows: Byron street, 30-inch by 45-inch brick sewer, $2.81; Tipton street, 24-inch by 36-inch brick sewer, $2.10; pipe sewer on same street, $1.85; Fisher & Keefer, Sabine St., 24-, 22-, 20-, 18- and 15-inch pipe sewer, $1.28; Guilford street, 15- and 18-inch pipe sewer, $1.59, Werling & Draper.

Sewer contracts have been awarded in Milwaukee, Wis., as follows: Eighteenth and Nineteenth avenues, and Rogers street, 2,974 feet, $1 per foot, J. Werner; Lincoln and Twelfth avenues, 1,290 feet, 97 cents per foot, D. O. Driscoll; Grant street and Sixteenth avenue, 1,664 feet, 89½ cents per foot, G. E. Zimmerman; Lapham street and Seventeenth avenue, 1,547 feet, 99 cents per foot, D. O. Driscoll; Orchard street, 821 feet, $1.03 per foot, D. O. Driscoll.

Director Windrim, Philadelphia, Pa., recently awarded contracts for sewer construction as follows: Sewer in line of Pennsylvania avenue, from Powelton avenue to Station 19, Ryan & Kelly, $102,000; remaining section of Pennsylvania avenue, James A. Mundy & Bro., $138,000; The Callowhill street system, which is divided into three contracts, was awarded as follows: C. P. Grim & Co., $94,000; G. W. Rusch, $75,000; John McCann, $47,000. G. W. Rusch was also awarded the contracts for the main sewer of the Twelfth street system, for $25,000, and the Allegheny avenue extension for $80,000.

WATER-WORKS.

The water-works plant at Eureka Springs, Ark., will cost $100,000.

The Green Bay (Wis.) and Fort Howard water-works plant has been sold to Eli Marvin, of Indianapolis, George H. Norman and G. Norman Weaver, of Connecticut, and a local syndicate of Green Bay, for $300,000.

CONTEMPLATED WORK.

Bancroft, N. D., has voted in favor of water-works.

An additional water supply is needed at Rock Island, Ill.

A $50,000 water-works plant is contemplated at Riverside, Ohio.

Brightwood, Ind., voted in favor of water-works, September 22.

The water supply is one of the important questions at New Bedford, Mass.

Broken Bow, Neb., contemplates the purchase of the water-works plant at that place.

An election will be held at Clifton, Kan., October 1, to vote bonds for $5,000 for a system of water-works.

A committee has been appointed at Valatie, N. Y., to obtain information on the subject of water-works.

A new water-works system is contemplated at Warsaw, N. Y., the old system having become inadequate.

O. C. Hicks, city clerk of Bushnell, Ill., writes that the water committee contemplates putting in a deep well to increase the water supply.

The present water system at Manchester, Mich., is inadequate, and the city authorities are agitating the question of bringing water from several springs near the city.

Plans have been prepared for the extension and improvement of the water-works plant and facilities, at Chicago, which will require an expenditure of $500,000. The work will begin this fall.

Water-works are being agitated at the following places: Columbiana, Ohio; Oakland City, Ind.; Cottonwood, Minn.; Lena, Ill.; Fayette, Iowa; Shelby, Ohio; Ellis, Kan.; St. Charles, Minn.; Lagro, Ind.; Dexter, Iowa.

The construction of water-works is contemplated at the following places: Sabbula, Iowa; East Connersville, Ind.; Pella Iowa; Lakeview, Mich.; Tolono, Ill.; Angola, Ind.; Graysville, Ind.; Vermillion, Ohio; Home City, Ohio; Plainview, Minn.; Wellington, Ohio; Celina, Ohio.

CONTRACTS TO BE LET.

Bids will probably be called, October 10, for a water-works system for Gibson City, Ill.

Bids are invited at Rossville, Ill., until October 12, for constructing a water-works system and stand-pipe.

CONTRACTS AWARDED.

The contract for building the water-works at Quincy, Mich., was awarded to C. T. Brooks, of Jackson, for $16,000.

The city council at Estherville, Ia., awarded to W. H. Hubbard, of Sioux Falls, S. D., the contract for water-works, for $10,594.

Bennett and Talbott, of Greensburg, Pa., secured the contract for constructing the water-works system, at Grafton, W. Va., for $32,327.

The contract for constructing a system of water-works for Fulda, Minn., was awarded to Tobin, Gleason & Smith, of Minneapolis, for $7,762.

Guild and White, of Chattanooga, Tenn., secured the contract for completing the system of water-works at Morgantown, Ky., at their bid of $25,000.

The U. S. Wind Engine and Pump Co., of Batavia, Ill., was awarded the contract for constructing the water-works system at Cedar Rapids, Ia., for $9,000.

BRIDGES.

A bridge is contemplated at West Knoxville, Tenn.

The bridge over the Sioux river, Castlewood, S. D., is completed.

Bids are invited until October 11 at Cincinnati, O., for improving the Eden Park bridge.

Sealed bids will be received until October 5 for constructing a swing bridge at Circleville, O.

The survey for the bridge between Rice and Connor's Point, Superior, Wis., has been completed.

New bridges have been recommended at Edgewood avenue, and at Olive street, New Haven, Conn.

The contract for two new iron bridges near New Castle, Ind., was awarded to the Indiana Bridge Co., of Muncie, Ind.

The contract for erecting a bridge over McKinley branch, near Banner, Ill., was awarded to J. P. Lingenfelter, of Canton, Ill.

The Toledo Bridge Company was awarded the contract for the High and Main street bridge, at Hamilton, Ohio, for $97,300.

The Wrought Iron Bridge Co., Canton, O., was awarded the contract for erecting a one span iron bridge, 32 feet long, near Otsego, O.

The contract for building a 70-foot wire bridge over the Embarrass river, in Champaign county, Ill., was awarded to Stalling Bros., of Danville.

Bids will be received until October 31, Chicago, Ill., for erecting certain swing or draw bridges along the line of the main drainage channel.

Two bridges will be built across the South river at Waynesville, Va., at a cost of $20,000 each, by John Boganshott, of Chattanooga, Tenn.

H. Ward, Binghamton, N. Y., writes that a highway bridge is to be built across the Susquehanna river, between the towns of Union and Vestal.

The contract for constructing a bridge across Swan creek, at St. Clair street, Toledo, Ohio, was awarded to the Massilon Bridge Company, for $25,000.

Two wooden bridges in Jenner township, near Somerset, Pa., were recently swept away during a storm. They will probably be replaced by iron structures.

The Lincoln county commissioners have petitioned for a bridge to be built over the Spokane river, and connecting with Stevens county, near Fort Spokane, Wash.

A bridge is to be constructed over the Olentangy river at West Goodale street, Columbus, Ohio, at a cost of about $50,000. No active steps have yet been taken.

The construction of a bridge is contemplated at Chickies, Pa., to cross the river between Chickies Rock and the Point. A suspension cable bridge is being considered.

Bids will be received until October 4 for the construction of a concrete or stone wagon bridge to be erected over Park avenue, near Tower Hill, in Eden Park, Cincinnati.

Bids are invited, at Cleveland, O., until October 3, for the construction and erection of the superstructure of the South Rocky river bridge, across the valley of the Rocky river.

Sealed proposals will be received until October 4, at Cleveland, O., for constructing the iron and steel superstructure of the bridge over the Cuyahoga river at Columbus street.

The Indiana Bridge Company of Muncie, Ind., has the contract for the Lemon bridge, crossing the Kankakee, near Walkerton, Ind. The bridge will be 400 feet long, and will cost $9,000.

The Wrought Iron Bridge Company of Canton, Ohio, which has the contract for the Turner bridge at Kansas City, Kan., has begun the work of construction. The bridge will be completed by January 1, 1895.

The contract for two stone masonry bridge abutments at Onondaga creek and Midland avenue, Syracuse, N. Y., has been awarded to Swift Bros., for $4,432.09. The Wrought Iron Bridge Company, of Canton, Ohio, was awarded the contract for the superstructure, which is a steel, low truss of 80-foot span, on an angle of 58°, with a roadway of 31 feet and two 6-foot sidewalks.

The contracts for the Jefferson street bridge at Cleveland, O., were awarded as follows: Repairing the substructure, Nicoll & Jones, $736.90; furnishing the superstructure, King Bridge Company $3,519.40.

The contract for building the Caldwell and Parma bridges, Caldwell, Idaho, was awarded to the Gillette Herzog Manufacturing Company of Minneapolis. The Caldwell bridge will cost $7,994, and the Parma bridge will cost $6,000.

The Wrought Iron Bridge Company, of Canton, O., was awarded the contract for a bridge at Boulder, Col. The bridge will consist of two spans of fifty feet each, with sixteen feet of roadway and six feet of sidewalk. The bridge will be completed by September 15.

Bridges have been recommended at Washington, D. C., as follows: K street bridge over Rock creek, $20,000; Navy Yard bridge over the Eastern branch, $250,000; M street bridge over Rock creek, $30,000; bridge over Rock creek on the Massachusetts avenue line, $175,000; that the approaches and superstructure of the P street bridge be widened, and the bridge provided with the paved floor system, $35,000.

PARKS.

Plans have been prepared for the improvement of Franklin Square, Rochester, N. Y.

The citizens of Humeston, Ia., recently voted to levy a special tax for park improvements.

Swinney Park, at Ft. Wayne, Ind., will be improved at an estimated cost of $25,000 or $30,000.

An appropriation of $1,000,000 is favored at Baltimore, Md., with which to purchase Clifton, and other parks.

A committee of three has been appointed at Peoria, Ill., who will give their entire attention to the selection of sites for public park purposes.

STREET RAILWAYS.

A new street railway is contemplated at Peoria, Ill.

An electric line between Hammond, Ind., and Chicago is contemplated.

An electric railway will be built between South Bend, Ind., and Mishawaka.

An extension of its lines is contemplated by the City and Suburban Electric Railway Company, Catonsville, Md.

An electric line to connect Watch Hill and Narragansett Pier, R. I., is being discussed.

The citizens of Corydon and Leavenworth are agitating the question of an electric line between New Albany, Ind., and Wyandotte Cave.

An effort is being made to organize a company to construct and operate an electric railway between Boise City, Idaho, and Lewiston, a distance of 300 miles.

F. F. Rogers, Port Huron, Mich., writes that the City Electric Railway Company will extend its line west on Water street and Lapeer avenue about one mile.

Dr. Charles E. Davis, Eureka Springs, Ark., writes that the city contemplates putting in an electric railway, forty-five miles in length, to connect a line of neighboring towns.

MUNICIPAL BONDS.

Bids are asked at Napoleon, O., until Oct. 8, for $2,400 of 6 per cent. bonds.

Bids are invited until Oct. 13, at Riverside, O., for $10,000 of 5 per cent. bonds.

Bids will be received at Norwood, O., until Oct. 15, for $15,000 of 5 per cent. bonds.

Bids are invited at Cleveland, O., until Oct. 3, for $150,000 of 5 per cent. bridge bonds.

Bids will be received until Oct. 4, at Bucyrus, O., for the purchase of $12,000 of 6 per cent. bonds.

Bids are invited until Oct. 16, at Spokane, Wash., for the purchase of $50,000 of 8 per cent. bonds.

A special election will be held at Aberdeen, S. D., Oct. 4, to vote on issuing $20,000 worth of bonds.

Bids will be received at St. Bernard, O., until Oct. 18, for the purchase of $3,361.96 of 6 per cent. bonds.

Bids are asked until Oct. 16, at Milwaukee, Wis., for the purchase of $50,000 of 5 per cent. bonds.

Bids are invited, at Echo, Minn., until Oct. 13, for the purchase of $4,200 of 6 per cent. water-works bonds.

Sealed bids will be received until Oct. 5, at Clarksville, Ia., for the purchase of $6,500 of 5 per cent. water-works bonds.